KENYA EDUCATION NETWORK

E-READINESS SURVEY OF EAST AFRICAN UNIVERSITIES (2008)

2008 E-READINESS SURVEY OF EAST AFRICAN UNIVERSITIES

A STUDY FUNDED BY THE ROCKEFELLER FOUNDATION

Professor Meoli Kashorda
Professor of Information Systems
US International University
Box 14634 00800, Nairobi, Kenya
meoli@usiu.ac.ke

Professor Timothy Waema
School of Computing and Informatics
University of Nairobi
Nairobi, Kenya
waema@uonbi.ac.ke

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ACRONYMS AND ABBREVIATIONS

ACRONYMS

AAU	Association for African Universities
B2B	Business-to-Business E-commerce
B2C	Business-to-Customer E-commerce
BW	Bandwidth
CCK	Communications Commission of Kenya
CEO	Chief Executive Officer
CID	Center for International Development, Harvard University, USA
CS, EE, IS	Computer Science, Electrical Engineering, Information Systems IT degrees
DVC	Deputy Vice Chancellor
EA	East Africa
ERP	Enterprise resource planning systems
GER	Gross enrolment ratios
Gb/s	Gigabits per second
ICT	Information and Communication Technology
IDI	ICT Development Index
IEEE	Institution of Electrical and Electronics Engineering
IRU	Indefeasible Rights of Usage
ITU	International Telecommunications Union
IP	Internet Protocol
ISP	Internet Service Providers
JKUAT	Jomo Kenyatta University of Agriculture & Technology
KDN	Kenya Data Network
KENET	Kenya Education Network
Kb/s	Kilobits per second transmission speeds
MIS	Management information systems
M&E	Monitoring and evaluation
Mb/s	Megabits per second
NOFBI	National Optical Fiber Backbone Infrastructure
NREN	National Research and Education Network
NRI	Networked Readiness Index
ODL	Open and Distance Learning
OSS	Open Source Software
OPAC	Online Public Access Catalogue
PDAs	Personal Digital Assistants
PBX	Private Branch Exchange
PC	Personal computer (desktop, latptop or notebook)
SCADA	
SPSS	Statistical Package for Social Scientists
UPS	Uninterruptible Power Supply
USIU	United States International University
USD	US Dollars
VCs	Vice Chancellors
VSAT	Very Small Aperture Terminal

Map of East Africa

ACKNOWLEDGEMENTS

This E-readiness survey of 53 East African universities was funded by Rockefeller Foundation. I thank the foundation for the support and in particular Dr. Katherine Namuddu, Rockefeller who has been especially helpful and supportive of the research project.

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This research project had many research assistants from different universities who coordinated the data collection by students and completed the directed questionnaires by interviewing heads of ICT and other senior members of the universities. The names of the research assistants are listed in Appendix and I appreciate their contribution to this research project.

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Professor Meoli Kashorda
Principal Investigator and Project Team Leader
Professor of Information Systems, United States International University (USIU) and
Executive Director, Kenya Education Network (KENET)
mkashorda@kenet.or.ke or meoli@usiu.ac.ke

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EXECUTIVE SUMMARY

Research Objectives

The main purpose of this e-readiness survey was to assess the preparedness of about 50 East African universities to use information and communication technology (ICT) for teaching, learning, research, and management. It was the first phase of a two-year "Accession of East African Universities Project" that aimed to develop generic and institutional roadmaps for universities committed to achieving higher stages of e-readiness.

The specific objectives of the project were to:

1. Conduct a *diagnostic* assessment of overall e-readiness of 50 universities in the five East African countries of Kenya, Uganda, Tanzania, Rwanda and Burundi, with a particular focus on the use of ICT for teaching, learning, and research.
2. Develop and disseminate generic roadmaps for accession of universities to stage 4 of e-readiness, which is the highest state of readiness to use ICT, according the 2008 staging framework [Kashorda and Waema, 2008].
3. Develop institutional roadmaps for accession to stage 4 of e-readiness in 17 indicators. The would include building the capacity for the ICT leadership in 10 universities selected on a competitive basis.
4. Identify and study at least two innovative projects that demonstrate the impact of ICT on learning outcomes in any degree program offered by universities in East Africa that are committed to developing institutional roadmaps.
5. Disseminate research findings in each of the five East African countries, in international conferences and refereed journals.

This report presents the results of the first two research objectives. It is divided into three: Part 1, comprising chapters 1 to 3, covers the methodology, data collection and analysis. Part 2 comprising chapters 4 to 8, covers the results for each category of indicators, while Part 3, comprising chapters 9 to 10, presents the conclusions and generic roadmaps arising from the proposed recommendations.

This e-readiness survey was conducted by Professor Meoli Kashorda (USIU, Kenya) and Professor Timothy Waema (University of Nairobi, Kenya) assisted by a coordinator, an assistant researcher and four associate researchers from each of the participating countries who coordinated the data collection. The survey was supported by a research grant from the Rockefeller Foundation, received through the Kenya Education Network (KENET) (http://www.kenet.or.ke), a trust created in 1999 by Kenyan universities to provide affordable Internet services to its member institutions.

Assessment framework and key results

The assessment framework used in this survey was derived from an e-readiness assessment tool originally developed by the Center for International Development (CID) at Harvard University (http://www.readinessguide.org). It was the same tool used in the the 2006 e-readiness survey of Kenyan Higher Education Institutions [Kashorda, 2007], with some minor modifications. It contained 17 indicators grouped into five categories: *network access, networked campus, networked learning, networked society, and institutional ICT strategy*. The staging for the 17 indicators was derived from the average of up to 60 sub-indicators similarly staged on a scale of 1 to 4 using the hard

facts and perceptions data collected from the 48 universities included in the survey. Stage 1 means unprepared and stage 4 is the highest stage of prepared for the particular indicator. As in the 2006 e-readiness survey, 15 strategic sub-indicators were also staged.

Data collection and analysis

Sixty-eight universities from all over East Africa applied to participate in the survey and 53 universities were selected as follows: Burundi (5), Kenya (17), Rwanda (8), Tanzania (12) and Uganda (11). However, only 49 universities successfully completed the detailed hard facts questionnaire required for the e-readiness analysis. Although the Open University of Tanzania completed the questionnaire, it was excluded from the final e-readiness analysis because analysis tools assumed a campus-based university. Therefore, 48 universities were used in the detailed analysis although perception data for all 53 universities surveyed was entered into the database.

Two detailed questionnaires were used to collect data, as follows:

- A hard facts questionnaire that was completed by heads of ICT and other senior university administrators such as finance managers and academic registrars.
- A perceptions questionnaire (field data) that was filled by students and staff in each of the 53 universities surveyed.

The questionnaires were administered to a statistically significant sample for each university. The total sample was 1,253 faculty members, 1,092 non-teaching staff and 24,889 students. A total of 27,234 questionnaires were completed. The data (hard facts and survey data) was entered into a Web-based database by students from the different universities (see: http://eready.kenet.or.ke) and is available to each of the universities. The data was analyzed using a comprehensive staging framework developed by the research team.

Staging results and key findings

This study analyzed the results for each of the five categories of indicators for each university. Figure 1 summarizes the results by presenting the average stage for each of the 17 indicators in a radar diagram. We note that, on average, the East African universities were at stage 2.0 and above in 10 of the 17 indicators. However, they only achieved stage 3.0 in one indicator of Locally Relevant Content and stage 2.5 and above in only four of the 17 indicators. Our analysis suggests that accession depends on the institutional ICT strategy category of indicators much more than the other categories of indicators. This will therefore be the main focus of the accession phase of this project.

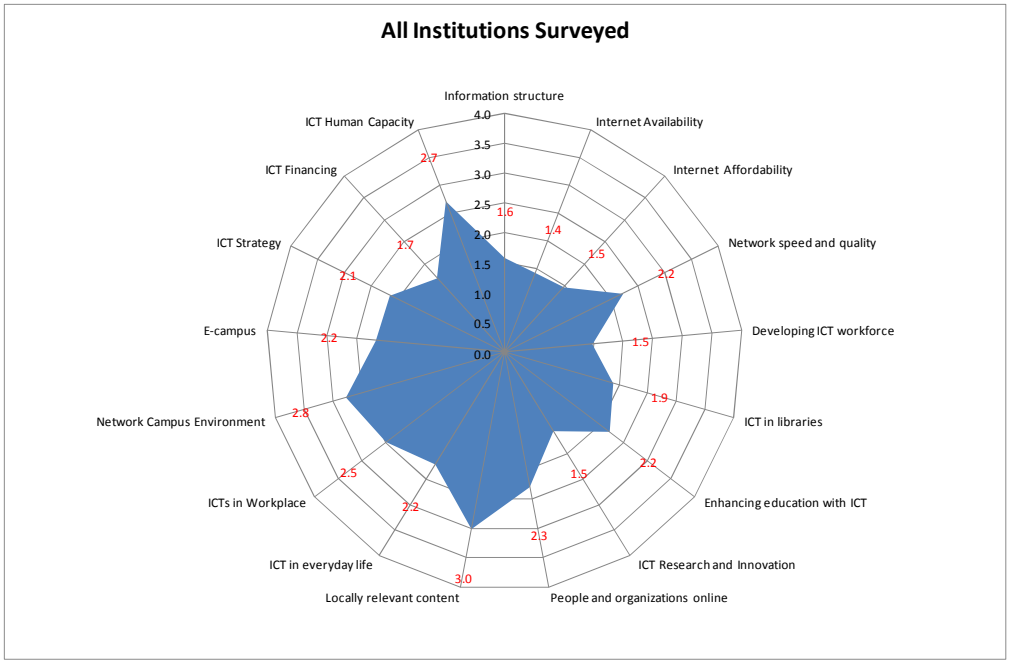


Figure 1: Average staging for 17 indicators for East African universities

Although the report analyzed the staging results for each of the five participating countries (see Chapter 9), we highlight the results for Kenyan universities by comparing the 2006 and 2008 survey results as shown in Figure 2. We note that there has been no significant accession to higher stages for the 17 Kenyan universities in the past two years. However, the results presented in this report show that Kenyan universities surveyed on average, were at higher stages of readiness in all the 17 indicators when compared to the universities in the other four countries.

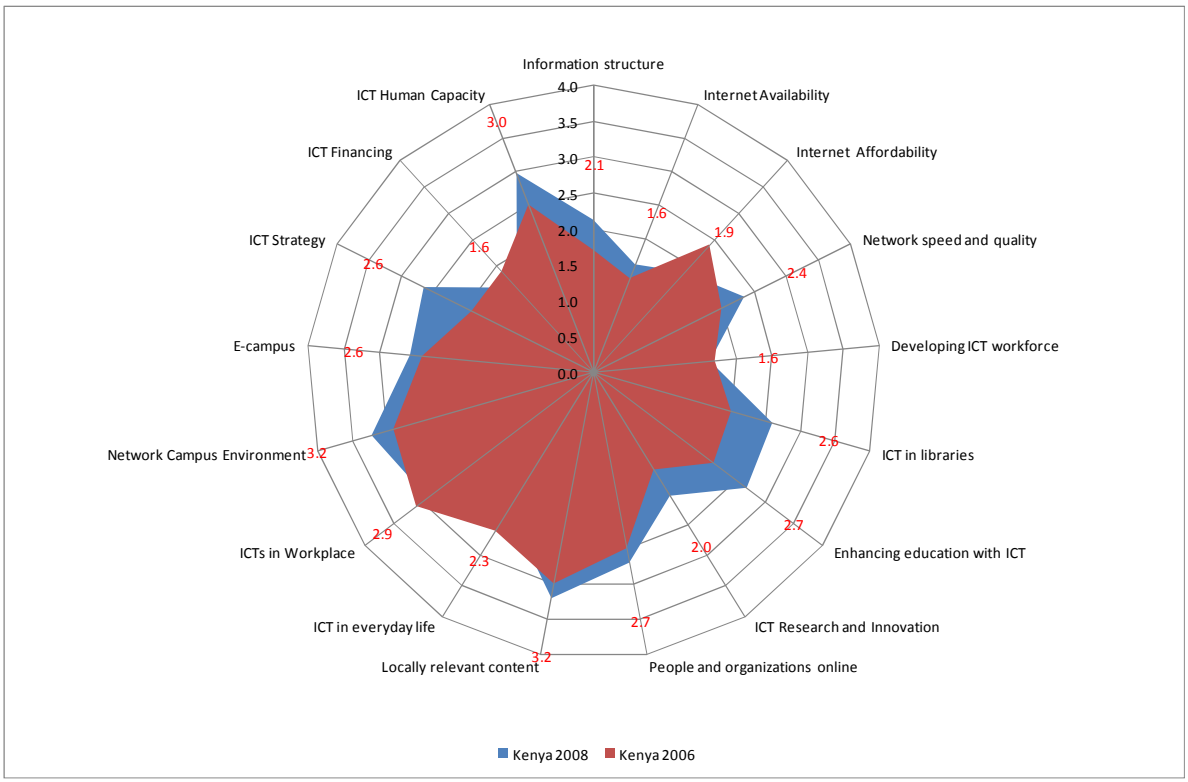


Figure 2: 2006 and 2008 survey comparison for Kenyan universities

The results suggest that accession to stage 4 is a slow process and could take up to four years. Although phase 2 of this project will reveal the factors that influence accession to higher stages, anecdotal data suggests that the Kenyan universities that responded to the 2006 survey had achieved stage 3.0 and above in most of the 17 indicators in two years. Moreover, an increase in ICT strategy stage translated into significant changes in networked learning category of indicators.. Examples of Kenyan universities that recorded the most dramatic accession in staging included Strathmore University (private) and Kenyatta University (public).

The network access category consisted of four indicators: information infrastructure, Internet availability, Internet affordability, and network speed and quality. On average, the universities were below stage 2 in all except the network speed and quality indicator. The low score in information infrastructure meant that university campuses were not providing adequate internal and/or internal voice communication services. This low internal teledensity could be improved by well-designed campus infrastructure. For example, all of the 48 universities were purchasing only 152 Mb/s for the total population of about 330,000 students, an overall ratio of only 0.45 Mb/s per 1000 students, less than 50% of the target of 1 Mb/s per 1000 students recommended in the 2006 survey. Similarly, the PC ratios were all below the ratio of 10 PCs per 100 students with highest being 7.3 per 100 students in Rwanda and only 1.5 PCs per 100 students in Burundi. Burundi and Tanzania had very low PC ratios at less than 3 PCs per 100 students.

The Internet affordability at stage 1.5 meant that universities were spending about US$ 13,000 per 1000 students, which represented less than 1% of their annual budgets. At stage 4, universities would be required to spend over US$ 37,000 per 1000 students at the 2008 average satellite bandwidth prices in East Africa of about $2,100 per Mb/s per month (see demographic data in Chapter 4).

The institutional ICT strategy category of indicators consisted of three indicators: ICT strategy, ICT financing, and ICT human capacity. Overall, Kenyan universities with an aggregate of stage 2.4 were marginally at a higher stage than all other universities at stage 2.1. This stage in ICT strategy signified that less than half of the ICT strategy had been implemented and only 33% of the ICT strategies were aligned to the mission of the universities. Moreover, only about 18% of the ICT heads reported directly to the Vice Chancellors (VCs). This suggests that the universities still do not consider ICT as strategic tool for achieving their educational outcomes.

The universities were in stage 1.7 in ICT financing as shown in Figure 1 meaning that they were spending just about 0.3% of their annual budgets on Internet bandwidth (Internet bandwidth cost was used as a proxy for ICT financing). The universities therefore, on average, had the capacity to increase Internet bandwidth budget to about 2% of their total expenditure required to be in stage 4 in this framework, assuming satellite bandwidth prices of over US$ 2,100 per Mb/s per month.

The universities were at relatively higher stage of 2.7 in the ICT human capacity indicator suggesting that they were attracting highly qualified ICT staff and retaining them for two to three years. The heads of ICT had at least a Bachelor's degree in ICT and many had postgraduate qualifications. Therefore, universities in East Africa possessed the human capacity required for large-scale use of ICTs in their campuses and only needed greater alignment of their ICT strategies to their learning outcomes and significant increases in their ICT budgets.

The main purpose of accession to higher stages in the four indicator categories of network access, networked society, networked campus, and institutional ICT strategy was to ensure that ICTs were used effectively to support learning, teaching, and research. This was measured using the networked learning category of indicators that consisted of the following indicators: developing ICT workforce, ICTs in libraries, ICT research and innovations, and enhancing ICT with education.

The results in Figure 1 show that the universities were at stage 1.5 in Developing ICT Workforce indicator. This implied that they were not training their faculty in common productivity tools or using e-learning to develop the ICT of faculty and staff, which consequently affected the adoption of ICT for learning and research. The universities were also at stage 1.5 in the ICT Research and Innovations indicator. This meant, for example, that although 72% of the universities surveyed were offering undergraduate ICT degrees, only 30% offered ICT degrees at Master's level and 12% at doctoral level. Anecdotal data suggested that the throughput of the Masters and PhD programs was very low meaning the universities did not have the required capacity to support undergraduate degree programs. Moreover, only 43% of ICT departments participated in national and international ICT exhibitions.

The universities were at stage 1.9 in ICTs in libraries indicator, which meant that most libraries were not automated and OPAC was not available off-campus despite the fact that most of students did not reside in university campuses. The few universities that achieved stage 3 and above in the ICT libraries indicator had automated all their frontend and backend processes and provided off-campus OPAC services. Example universities included USIU and University of Nairobi in Kenya, and Makerere University in Uganda.

The enhancing education with ICT indicator was at stage 2.2, meaning that only about 50% of the universities had course management systems, used for managing online courses, like WebCT, Blackboard or Moodle. There was also limited use of ICT in the classrooms and a significant number of student projects did not have an ICT component. However, a few universities had started recognizing ICT as a tool for enhancing education, with some leading universities achieving stage 3.0 and above. In general, such universities were also the ones where the champion for ICT was the Vice Chancellor or at least a Deputy Vice Chancellor.

Overall, however, the East African university community exhibited a high readiness to use ICT as shown by the relatively higher stages in networked society category of indicators. The network society category consisted of four indicators: ICT in the workplace, ICT in everyday life, people and organizations online, and locally relevant content. Figure 1 shows that the university community (i.e., students, faculty and staff) exhibited relatively high level of readiness at stage 2.0 and above in these indicators. The lowest was in ICTs in everyday life at stage 2.2, which is an indicator of the diffusion of ICT outside the university campus as well as the low ICT access for students within campuses. Limited availability of ICTs in the universities was driving the community to cyber cafés for computer and Internet. For example, about 50% of student respondents considered the cyber café as their primary access to computers and the Internet. This percentage was highest in countries at low stages in networked campus category of indicators, such as Burundi where 87% of the student respondents considered cyber cafés as their primary location for access to the computers.

The East African university community also used computers largely for e-mail with up to 72% of the students in Kenya, reporting that they used computers to access e-mail. The use of computers for data analysis was significant (10% to 40% depending on the country) suggesting the use of computers for learning and research. Computers were also used for word processing

(about 45% of student respondents) and for entertainment with about 50% of students in Kenya, Uganda, and Burundi reporting that they used computers and Internet for entertainment.

The results of gender analysis of the ICT revealed that there was no significant difference between the male and female students of the universities. This was also the finding in the 2006 study of Kenyan Higher Education community.

Internal vs. external factors of e-readiness of universities

Only three of the 17 indicators, namely, Internet availability, Internet affordability, and network environment (reliability of commercial power supply), directly depend on the external ICT environment. The governments in the all the East African countries had over the years improved the regulatory environment to ensure growth of the ICT sectors. Most of the universities surveyed were located in areas where commercial power was available but required backup generators and UPSs. The price of Internet was also expected to drop with availability of relatively cheap undersea optical fiber bandwidth from July 2009. This means that these three indicators that were directly affected by the external or national ICT environment will not be the key determinants of accession to higher stages in the important networked learning category of indicators. Instead, it will be internal institutional strategies that will determine accession to higher stages.

Although data on the Kenyan universities that used the results of the 2006 survey of their universities to revise their ICT strategies was not collected, anecdotal evidence suggests Kenyatta University and Strathmore University, may have used these results to improve on the stages of their indicators.

Strategic ICT sub-indicators

The2006 survey of e-readiness of higher education institutions in Kenya identified 15 sub-indicators that were considered strategic. These 15 strategic sub-indicators were selected from over 60 sub-indicators that were used to stage the 17 indicators. The purpose of identifying only 15 strategic indicators was to make it easier for universities to incorporate the indicators in their ICT and corporate strategies. In fact, the 2006 survey was summarized as an ICT strategy brief that could be used by the leadership of the universities [Kashorda and Waema, 2007b]. We note that most of the Kenyan universities had adopted two of the 15 indicators in their strategies, namely, PCs per 100 students and Internet bandwidth per 1000 students, as simple measures for investments in ICT. The PC ratio sub-indicator will continue to be important even as more students purchase their own computers and universities provide hotspots in their campuses. For example, this study found that a although 25% of students had access to computers at home, , the fact that about 50% of the students still had to access computers in cyber cafés meant that universities needed to continue investing in in campus-based computer labs.

Figure 3 on the staging for the strategic indicators for all the East African universities included in the analysis, shows that nine of the 15 sub-indicators were below stage 2.0. For example, Internet bandwidth per 1000 students was at stage 1.4, while the networked PCs per 100 students' sub-indicator was at stage 1.3. The universities were also spending relatively little on the Internet as measured by the Internet bandwidth cost per 1000 at stage 1.5. Consequently, the percentage of student respondents with campus access to computers was at stage 1.3.

The results in Figure 3 also show that the sub-indicator percentage of ICT implementation was at stage 1.5. This meant that only about 25% of the institutional ICT strategy had been

implemented according to this staging framework. Thus, EA universities will need to pay greater attention to ICT strategy and incorporate the strategic sub-indicators in their strategic plans. Unfortunately, the results for Kenyan universities show that there has been no significant accession to higher stages. Only a few Kenyan universities (e.g., Strathmore Universities and Kenyatta University) recorded significant accession in the staging of these sub-indicators. We note that accession to higher stages in sub-indicators and indicators is a challenging change management process that requires focus on ICT by the senior leadership of the universities. The second phase of this accession project will aim to establish the key drivers for accession that could then be incorporated in the institutional roadmaps.

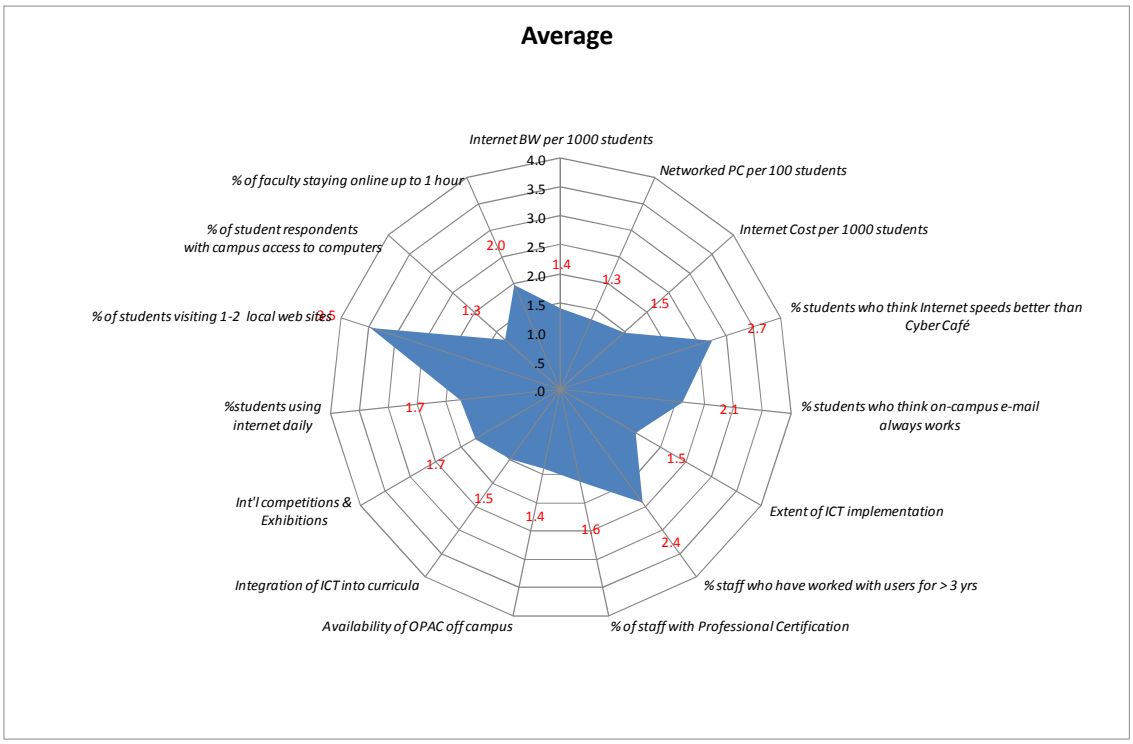


Figure 3: Average stages for 15 strategic indicators for all East African universities

Summary results and conclusions

The main conclusion of this survey is that the higher education community, especially the university community in Kenya, is ready to use ICT for learning, teaching, research and management. However, the institutional leadership appeared not to have recognized ICT as a strategic priority for transforming teaching, learning, and research. Consequently, institutions were allocating low operational budgets to ICT, did not invest adequately in campus networks, and did not have strategies for building the capacity of faculty to use ICT effectively to support their teaching and research activities. Most of the universities had not even automated their operational systems and processes, including library operations.

The 2006 e-readiness survey introduced 15 strategic sub-indicators. The accession in staging of the 15 strategic indicators for Kenyan universities did not show any significant accession to higher stages in the 2008 survey. This would suggest that most the Kenyan universities were not tracking the strategic sub-indicators and that ICT was still not considered a strategic tool by the university leadership. However, anecdotal evidence suggests that even universities that had adopted some of the 2006 survey recommendations were only using a few of the 15 strategic

sub-indicators. We therefore recommend universities start accession by focusing on the following five strategic sub-indicators:

a. Internet bandwidth cost per 1000 students
b. Internet bandwidth per 1000 students
c. PCs per 100 students
d. Extent of ICT strategy implementation
e. Integration of ICT in curricula

In almost all the 48 universities, ICT financial data was difficult to collect possibly because it was not treated as a separate expenditure or budgeting category at most of the universities. We recommend that universities create a separate budget line for ICT which includes Internet bandwidth, academic campus networks, associated salaries of ICT professionals, and the ICT capacity development for faculty.

This study did not factor mobile Internet usage sub-indicator in calculating the staging for Internet availability. Since about 50% of the student respondents reported that they were using mobile Internet, this would need to be factored in staging of the Internet availability indicator in the future. Data was also not collected to establish how, if at all, the students used the mobile Internet to support learning. Phase 2 of this project on innovative ICT projects will therefore give priority to innovative mobile learning technologies because of the pervasiveness of mobile phones in East Africa.

This report analyzed the effect of size on the staging of the 17 indicators. The universities were classified as small (1,000 – 2,500 students), medium-sized (2,501 – 5,000), large (5,001 – 20,000) and very large (over 20,000 students). The results show that size matters in terms of the average stages of most indicators. The researchers had expected that small universities to adopt ICT faster and therefore achieve higher staging in networked learning category of indicators (i.e., transform learning). However, the results showed that it was the very large and well-established universities that were effectively transforming learning using ICT as measured by the higher staging in networked learning category of indicators. Phase 2 of this project will aim to establish the factors that drive accession to higher for the different size categories of universities.

Critical issues and generic roadmaps

This report has developed generic roadmaps for each of the five categories of indicators. Critical issues were identified for each category and then generic roadmaps developed. For example, one of the critical issues identified for accession of the Internet availability was the number of PCs available to students when compared to the total number of PCs in a university. The results showed that in Tanzania students had access to 5.4% of the total number of computers in the universities while in Rwanda, 71% of the computers were for students. Since the student numbers are significantly higher than the faculty and staff numbers, the universities could increase their staging by simply by placing a a higher fraction of the computers purchased to student computer laboratories.

Table 1 shows the critical issues and generic roadmaps for the institutional ICT strategy category of indicators. The roadmaps show what the institutions needed to do in order to achieve higher stages of readiness. Although low allocation of resources was identified as one of the critical issues and the generic roadmap required gradual increases in budgets, most of the other critical issues did not require additional financial resources. However, universities needed to start allocating adequate resources to support learning

Table 1: Critical issues and generic roadmap for institutional ICT strategy indicators

Critical issues	Accession strategy	Time and resources/initiatives required		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Low resource allocation to ICT, especially for student PCs	Allocate at least 3% of total institutional budget to ICT (excluding personnel emoluments)	• In next 1 year • Additional budget for ICT capex and opex	• In next 2 years • Additional budget for ICT capex and opex	• In next 3 years • Additional budget for ICT capex and opex
Lack of ICT financial data	Maintain ICT financial data as part of the institutional financial management system	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item
Low profile of ICT function	Raise the profile of ICT by upgrading the head of ICT to be at least at Registrar grade level, to report to the CEO and to become a member of senior management	• Immediately • Workshops and new statutes for ICT + increased salary of ICT Director	• Next 1 year • Workshops and new statutes for ICT + increased salary of ICT Director	• Next 2 years • Workshops and new statutes for ICT + increased salary of ICT Director
Low championship of ICT	CEOs and their senior managers to champion ICT in their institutions	• Immediately • Awareness workshops for senior management	• Next 1 year • Awareness workshops for senior management	• Next 2 years • Awareness workshops for senior management
Low level of alignment of ICT strategy to corporate strategy	Adopt and make the strategic ICT indicators an integral component of the corporate strategic plan and monitor these together with the other corporate performance indicators	• Immediately • Workshops to review existing corporate strategic plans	• Next 1 year • ICT and corporate strategic planning workshops	• Next 2 years • ICT and corporate strategic planning workshops
Incomplete implementation of ICT strategies	Create a sound monitoring and evaluation framework and follow it	• Immediately • Workshops to review existing M&E frameworks	• Next 1 year • Workshops to develop M&E frameworks	• Next 2 years • Workshops to develop M&E frameworks
Limited ability to attract and retain quality professional ICT staff	Implement mechanisms for attracting and retaining professional ICT staff (e.g. attractive scheme of service for ICT and putting in place a staff development program for ICT staff)	• Immediately • Workshops to review schemes of service and other mechanisms	• Next 1 year • Workshops to develop schemes of service and other mechanisms	• Next 2 years • Workshops to develop schemes of service and other mechanisms

This was the second detailed e-readiness survey of universities in Kenya but the first for the other East African countries. Although Kenyan universities found it relatively easy to complete the hard facts questionnaires, getting student enrollment and financial data, still posed a challenge. For the other universities, completing the financial data was very challenging, as had been the case for Kenya in 2006. This was partly due to lack of integrated information system, but the relatively low profile of the heads of ICT who mainly focused on technical rather than business issues.

One of the advantages of this survey is that it is now an accession project that has developed generic roadmaps that most of the universities could use for accession to higher stages. The 10 universities that will participate in the development of institutional roadmaps will also help in refining the indicators. A time series of the data will then show how the indicators are changing in response to the staging analysis.

Although the hard facts questionnaire was long and detailed, there will still be a need to collect detailed data for different academic departments and their programs. For example, there was no detailed data on the throughput of PhD and Master's programs or even the fraction of courses that have an online component. We also recommend that other detailed academic area-specific e-readiness surveys to be conducted. This is because anecdotal evidence suggests that many universities have apparent "digital-divides" of different academic departments in large universities. This additional data collection and analysis will require the establishment of well-funded ICT readiness observatory at KENET.

PART 1: RESEARCH CONTEXT AND METHODOLOGY

1. INTRODUCTION

1.1 BACKGROUND

In 2006, KENET researchers conducted the first e-readiness survey of 25 Kenyan universities that included 17 universities, with a grant from the Ford Foundation and the Rockefeller Foundation [Kashorda, 2007]. The survey used a diagnostic assessment tool containing 17 indicators classified in five categories: *network access; networked campus; networked learning; networked society and institutional information and communication technologies (ICT) policy and strategy.* Each indicator was staged on a scale of 1.0 to 4.0 where 1.0 represented the lowest stage of readiness and 4.0 the highest. The survey also identified 15 strategic sub-indicators that could be used as performance indicators in institutional ICT and corporate strategic plans. The survey was subsequently summarized as an ICT strategy brief that was launched in September 2007 by KENET in collaboration with the Ministry of Education in Kenya [Kashorda and Waema, 2007].

The survey and ICT strategy brief provided Kenya's Ministry of Education and KENET member institutions with concrete performance indicators for measuring readiness to use ICT in teaching, learning, and research. The results indicated that Kenyan universities were not yet ready to use ICT to transform teaching, learning and research as most of them were placed at stage 2.5 and below in 13 of the 17 indicators. For example, the institutions were at stage 1.4 in Internet availability measured using PCs per 100 students and Internet bandwidth per 1000 students. The study therefore recommended a target of 10 PCs per 100 students and a bandwidth ratio of 1 Mb/s per 1000 students as the starting point for transforming learning using ICT. However, accession to stage 4.0 in all 17 indicators would require focus on ICT as a strategic tool for transformation.

In December 2007 the researchers, through KENET, received another grant for a broader survey covering 50 universities in the five East African countries of Burundi, Kenya, Rwanda, Tanzania and Uganda. The main purpose of the e-readiness survey was to help the universities to transform education using ICT, and the survey which was conducted between November 2008 and the early part of 2009, formed the basis for developing generic and institutional roadmaps for accession to higher stages in all 17 indicators. This report contains the results of the survey, which was part of the first phase of a two-year "*Accession of East African Universities Project.*"

This section gives an overview of the context of higher education in East Africa and trends in national ICT infrastructure. It also presents the terms of reference for the broader accession project, its assessment framework and its key findings.

1.2 CONTEXT OF HIGHER EDUCATION IN EAST AFRICA

Information and communication technologies enhance the quality of teaching and learning, research productivity of faculty and students, as well as the management and effectiveness of universities. In addition, use of ICT in universities develops future workforce that can effectively participate in the increasingly networked world and emerging knowledge economy (Soumitra Dutta, 2003, Anuja Utz, 2006). Graduates from these universities are expected to take leadership positions in government, business, and society and will therefore play a critical role in transforming East Africa into an information society. Table 1.1 shows the tertiary gross enrollment ratios (GER) of the five East African countries in 2007 [UNESCOa, 2009]. In general, the GER was below the sub-Sahara Africa average GER of 6%. Tanzania in particular had a low GER of 1%. Thus, universities in East Africa are expected to continue to increase their enrollment. The following section presents an overview of the context of higher education in each of the five East African countries.

Table 1.1: Tertiary Gross Enrollment Ratios of East African countries

Country	Tertiary GER (2007)
Kenya	3%
Uganda*	3%
Tanzania	1%
Rwanda	3%
Burundi	2%
South Africa	15%
Sub-Sahara Africa	6%

Source: UNESCO GED, 2009; only 2002 data available for Uganda

1.2.1 HIGHER EDUCATION IN KENYA

Kenya had a tertiary Gross Enrollment Ratio (GER) of about 3% in 2007, which was below the 6% average for sub-Sahara Africa (UNESCO, 2009). It had a tertiary outbound student mobility of 11% which means the demand for tertiary and university education is very high. South Africa, for example, had a tertiary GER of 15% and an outbound mobility of only 0.8% in 2007. About 50% of university students in Kenya are privately sponsored in public or private universities. These students are either part-time, full-time or distance education students. Increasing the GER in Kenya would require the use of open and distance learning (ODL) [GoKa, 2008, National Strategy]. This also requires the use of ICT-based e-learning technologies. Thus, the capacity to use e-learning to increase enrollment has to be developed within the university community first by ensuring the e-readiness of existing and new universities.

Kenya had seven public universities, eight public university colleges and 11 fully chartered private universities in 2008. In addition, eight private universities had a letter of interim authority from the Kenya government through the Commission for Higher Education (http://www.che.ac.ke). This study surveyed 17 universities (nine public and eight private universities) that had a total enrollment of over 162,319 students. These were the same institutions surveyed in the 2006 study [Kashorda, 2007].

The demand for university education in Kenya remains high and enrollment has grown dramatically over the past eight years. For example, in the 2006 survey the 17 universities had a total enrollment of about 141,830 students, meaning there has been an increase of about 14% over two years. However, growth has mainly been in the privately sponsored fee paying students, either enrolled in the private universities or public universities. For example, the public universities increased their enrollment by admitting evening and weekend students in what is referred to as Module II or parallel degree programs. Another method used by both private and public universities to increase enrollment is establishing satellite campuses in major cities and towns. Consequently, about 50% of the students enrolled in public universities in Kenya are privately sponsored non-residential students. This group of students could benefit from e-learning technologies and ICT to supplement classroom instruction.

The University of Nairobi and Kenyatta University already have operational open and distance learning programs using a combination of learning centers, e-learning, and traditional correspondence-based distance education. The government approved the establishment of a national open university in 2008 which is expected to use ICT and the Internet to deliver its programs. Another method used by public universities to increase enrollment and expand access

to university education is through offering degrees in partnership with local middle-level colleges. This study did not include students enrolled in such middle-level colleges. Total university enrollment in Kenya is likely to be over 200,000 students.

ICT degree programs were very popular and all universities in Kenya offered at least one ICT degree program at the undergraduate level (e.g. computer science, information systems, electrical engineering, etc.). Apart from the degree programs, most of the universities also offered IT literacy and foundation courses. There was therefore increasing need to use ICT in universities.

1.2.2 Higher education in Uganda

There has been a relatively rapid expansion of higher education in Uganda over the past 20 years, growing from one public university (Makerere University) to the current four public universities and 26 private universities that either have a full charter, a license, or a letter of interim authority from the Uganda National Council for Higher Education. Table 1.1 shows that Uganda had a GER of 3% 2002 (UNESCO, 2009), and private universities are expected to absorb the increasing demand for university education in the country.

Enrollment at the 10 universities included in this survey was 95,550 with Makerere University alone having an enrollment of 38,000 students. Apart from the increase in private universities, the growth in university enrollment is largely being addressed through evening and weekend degree programs as well as establishing satellite study centers and colleges in major towns across Uganda. A strategy that also supplements and complements the growth of satellite units is increasing the use of open and distance learning (ODL) leveraged by ICT-based e-learning technologies. But, as in Kenya, the capacity to use e-learning to increase enrollment has to be developed in the universities first by ensuring the e-readiness of existing and new universities.

1.2.3 Higher education in Tanzania

Before 1990, Tanzania had four higher learning institutions comprising two universities and two institutes all owned by the government. These were the University of Dar es Salaam (UDSM), Sokoine University of Agriculture (SUA), Dar es Salaam Institute of Finance Management (IFM) and the Mzumbe Institute of Development Management (IDM). The University of Dar es Salaam, the first in Tanzania, was established in 1967, while Sokoine University of Agriculture was established in 1986.

The demand for higher education continued to increase in Tanzania through the 1990s. In 1995, the government liberalized higher education and allowed the establishment of private independent higher learning institutes. By 2008, there were 54 higher education institutions (HEIs) in 10 regions in the country with 19 HEIs in Dar-es-Salaam, four in Zanzibar and the rest in other regions including Dodoma, Morogoro, Iringa, Mbeya, Tanga, Moshi, Arusha and Mwanza. However, the GER of Tanzania was only 1% in 2007 as shown in Table 1.1 [UNESCO, 2009], the lowest in the East Africa. This was probably the reason for Tanzania establishing the fully-fledged Open University of Tanzania, which had about 40,000 students in 2008.

The e-readiness survey included nine universities with a total student enrollment of 41,816 students. The University of Dar-es-salaam was still the largest university in 2008 with 21,266 students. All the other universities were relatively small with less than 4,000 students. Tanzania is therefore expected to experience growth of university student enrollment in the next five years.

1.2.4 Higher education in Rwanda

In 2008, student enrollment in higher learning institutions in Rwanda increased drastically and currently students' population in public institutions of higher learning stands at 20,858 [GoR, 2008]. The student population in private higher education institutions was estimated at around 25,000 bringing the total number of students in higher learning institutions to 45,858. Table 1.1 shows that the GER of Rwanda was 3% in 2006. Nearly 97% of university programs in Rwanda are undergraduate programs.

The seven universities included in the 2008 survey had a combined enrollment of 32,450 students and therefore represented a significant percentage of the higher education enrollment in Rwanda. The country is expected to experience dramatic growth, in both private and public universities, in the next five years.

1.2.5 Higher education in Burundi

Burundi had 17 universities in 2008: five public and 12 private [GoB, 2008]. Most of the private universities were new with the oldest being just 10 years. The private universities were established because of the limited capacity of the public universities and they continue to improve in the quality of education they offer. Table 1.1 shows that Burundi had a GER of 2% in 2007.

The five public universities in Burundi were Université du Burundi, Ecole Normale Supérieure (ENS), Institut supérieur de Police (ISP), Institut National de santé Public (INSP) and Institut Supérieur des Cadres Militaires (ISCAM). Other than Université du Burundi, the other public universities offered specialist professional degree programs in medicine, nursing, or teacher education. All of universities in Burundi offer ICT courses and/or degree programs.

The Government of Burundi, in cooperation with local and international organizations, provide various incentives to support graduate students (as well as ICT studies). For example, students in universities (private and public) receive scholarships from the government, while some public universities provide them with residences. Through collaborative agreements between the government of Burundi and foreign donors (mainly Belgium, China, Canada, and South Africa) some Burundian students go abroad for their postgraduate studies. For those who cannot go abroad, the AUF (Agence Universitaire de la Francophonie) provides e-learning platforms for courses that are not available locally.

1.3 INFORMATION AND COMMUNICATION INDICATORS IN EAST AFRICA

1.3.1 Networked Readiness Index of East African Countries

The World Economic Forum ranks countries using the Networked Readiness Index (NRI), which was originally derived from the assessment tool developed by the Center for International Development, Information Technology Group, at Harvard University [Dutta, 2008]. This

assessment tool, also called the CID assessment tool, motivated the assessment framework used in this report. The NRI measures the readiness of a country in the three dimensions of ICT environment (regulatory and ICT infrastructure), the readiness of government, businesses, and individuals, as the usage of ICT by individual, businesses, and the government as shown in Figure 1.1. Thus, it is a good indicator of the ICT readiness of a country.

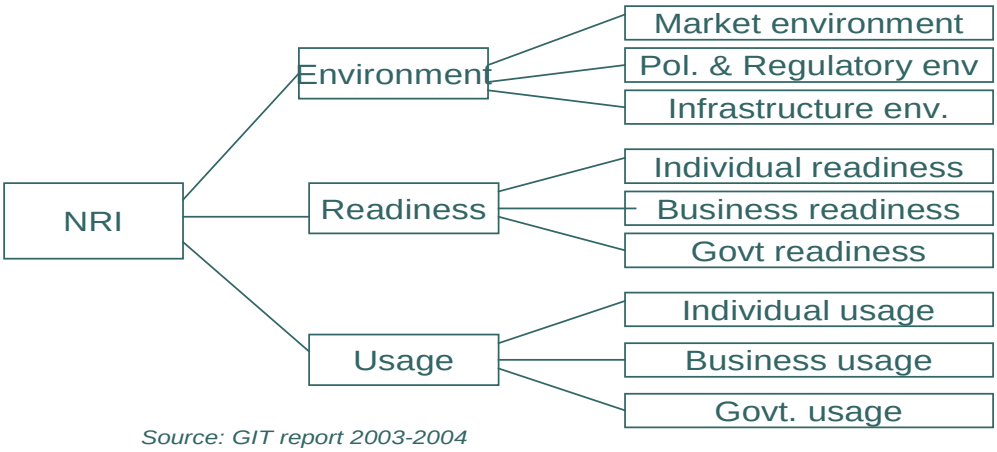


Figure 1.1: Networked readiness index sub-indexes

Table 1.2 shows the NRI 2006 – 2008 results for the five East African countries. The table includes ranking for Mauritius, and South Africa for comparison (Dutta, 2007; Dutta, 2008; Dutta, 2009). In 2008, Kenya was ranked at position 97 out of 134 countries. A low ranking suggests low level of readiness and usage by businesses, government and individuals. Kenya on average performed better than the other ranked East African countries in the last two years while Tanzania performed the best in 2006/2007. Unfortunately, Rwanda was not ranked.

Table 1.2: Networked readiness index of selected countries

Period	South Africa	Mauritius	Kenya	Tanzania	Uganda	Burundi
2006-07 (122 countries)	47	51	95	91	100	121
2007-08 (127 countries)	51	54	92	100	109	127
2008-09 (134 countries)	52	51	97	119	120	131

Source: World Economic Forum / INSEAD Global IT Reports

The International Telecommunications Union (ITU) developed an ICT index, the ICT Development Index (IDI) [ITU, 2007]. The index measures:

- Development of ICT in countries and relative to other countries (i.e. track ICT progress over time).
- Level of advancement of ICT in all countries (i.e., the index should be global and reflect changes in both developed and developing worlds).
- Digital divide, i.e. differences among countries with different levels of ICT development.

- Development potential of ICT or the extent to which countries can use ICT to enhance growth and development, based on available capabilities and skills.

Most of the data used for ranking was obtained from ICT regulators in the different countries.

Table 1.3 shows IDI for 2002 and 2007. Kenya once again performed better than the other East African countries. Rwanda performed better than Tanzania across the period while Burundi was not ranked.

Table 1.3: ICT Development Index for the five East African countries

Year	South Africa	Mauritius	Kenya	Tanzania	Uganda	Burundi	Rwanda
2002 (Rank out of 154 countries)	77	61	116	138	143	Not ranked	136
2007 (Rank out of 154 countries	87	62	116	145	140	Not ranked	143

Source: ITU, 2009

Overall, East African countries performed poorly by global standards in the NRI ranking as shown in Table 1.2.. The challenge is therefore to ensure that the higher education graduates in East Africa achieve similar learning outcomes in terms of readiness to use ICT as those in countries with higher ICT index ranking. Although universities will continue to operate within constraints of the national information infrastructure (NII) as outlined above, this study found that it was possible to achieve international standards in use of ICT by focusing on the readiness of the campuses.

1.3.2 Trends in Internet backbone infrastructures in East Africa

All the East African countries were connecting to the global Internet via satellite links. The bandwidth prices available to the gateway providers averaged US$ 2,100 per Mb/s per month in 2007 [Internet Market Analysis, 2007] and about US$ 5,000 to the end users. However, universities in East Africa purchased bandwidth at average prices of US$ 2,100 per Mb/s per month in that year partly because of subsidies. For example, the Rwanda government subsidized Internet bandwidth for universities to the tune of US$ 2,500 per Mb/s per month using the universal access fund. The universities therefore paid only US$ 500 per Mb/s per month. Some universities also benefited from bandwidth subsidies obtained through the Partnership for Higher Education.

However, two undersea optical fiber cables were scheduled to become operational in July 2009. These were SEACOM, a private undersea cable operator, and TEAMs (East African Marine Systems), initially fronted by the government of Kenya, but currently with 80% owned by private operators (Business Daily July 22, 2009]. These cables are expected to provide a total of 2,380 Gigabit/s bandwidth (see http://manypossibilities.net/african-undersea-cables/) and prices are expected to fall to under US$ 500 per Mb/s per month. The third, EASSy cable, is expected to land in East Africa in 2010. Undersea cable bandwidth will therefore be available to all the five East African countries through their respective telecommunications operators from July 2009.

All the five East African countries were investing in national optical fiber networks. For example, licensed telecommunications operators in Kenya have been laying optical fiber in towns and cities since 2005. In Kenya, two infrastructure operators already had a national reach of

operational optical fiber links that provided leased lines to organizations, including universities at competitive prices. In addition, the Kenya government has also been implementing the National Optical Fiber Backbone Infrastructure (NOFBI) to all the district headquarters (http://www.kenyaengineer.or.ke). About 4,200 kilometres of open access cable infrastructure had been installed by April 2009 in readiness for distributing the undersea cable bandwidth. Similar national optical fiber backbone projects were under construction and most were expected to be operational by 2010.

The power utility companies in East Africa had either installed or were planning to install overhead optical fiber links for their SCADA applications. They all planned to use the spare to offer backbone optical fiber links to licensed operators. Similarly other utility operators were also installing optical fiber links that could be made available to operators, including the National Research and Education Networks (NRENs).

Apart from the optical networks, mobile telecommunication networks in the region have continued to grow. Table 1.4 shows the mobile subscribers in four of the countries (Burundi data was for September 2007). Mobile teledensity ranged from about 14% for Rwanda to 44% for Kenya with Burundi being the only exception. Since all the mobile operators in East Africa also offer mobile Internet services, with some already offering 3G services in selected areas, mobile Internet may become the primary method of access for university students. For example, 50% of the students in the 48 universities surveyed reported that they used mobile Internet services, mostly from their mobile phones.

Table 1.4: Mobile customers in 2008

Country	Mobile customer (December 2008)	Mobile Teledensity
Kenya	16,233,833	43.6
Uganda	8,554,864	29.0
Tanzania	13,006,793	32.0
Rwanda	1,322,637	13.8
Burundi*	240,700	3

Source: Regulators, CCK, 2008, UCC, 2008, TCRA, 2008, RURA, 2007
Burundi Data is for September 2007

1.3.3 National Research and Education Networks in East Africa

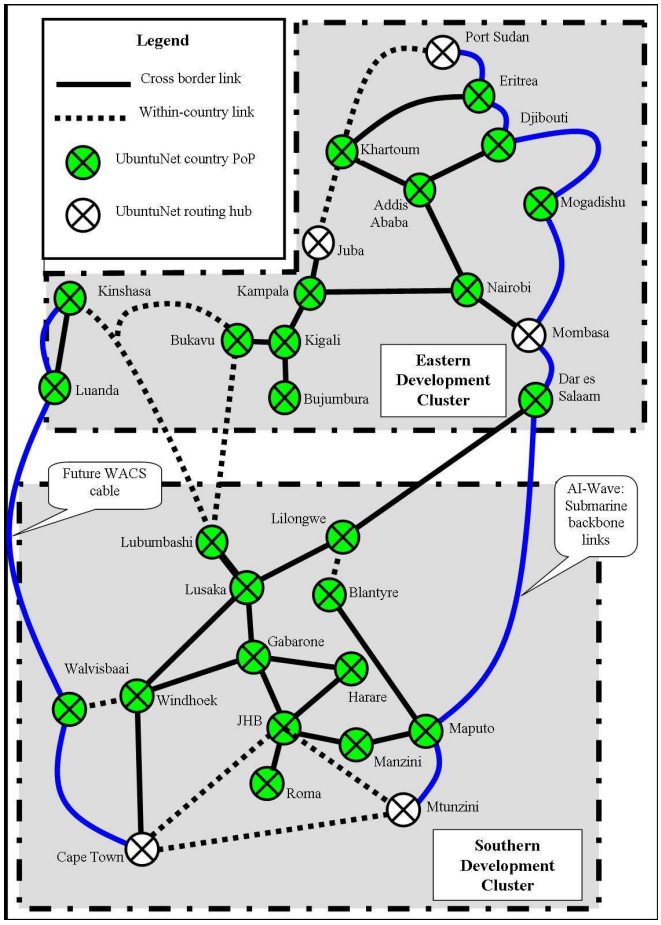
The East African universities have over the past 10 years been establishing National Research and Education Networks (NRENs) to physically interconnect the universities and provide high speed and cost effective access to the global Internet. KENET, the Kenyan NREN was created in 1999 and has been in operation from 2000 (http://www.kenet.or.ke). In 2008 it provided connectivity to 10 of its member universities directly or through licensed operators, and distributed about 30 Mb/s of satellite bandwidth. It was registered as NREN by AFRINIC and had its own pool of IP addresses and an Autonomous System Number.

In 2009, the KENET network was upgraded with the bulk purchase of about 214 Mb/s of satellite bandwidth that was distributed to 34 member institutions, including all the 17 universities included in this survey. The broadband used optical fiber leased lines to connect the universities. This is the same network that will be used to distribute undersea cable bandwidth.

Uganda launched its Research and Education Network (http://www.renu.ac.ug) in 2007 and it is expected to start providing connectivity services in 2009. Tanzania launched its NREN, called Tanzania Education and Research Network (http://www.ternet.or.tz) in 2008 and it is also

expected to become a fully operational network by 2009. Similarly, the Rwanda Education Network (RwEdNet) has already been created with some of the universities as members but is not yet operational. Burundi is in the process of developing its NREN with the support of Ubuntunet Alliance (http://www.ubuntunet.net), the regional research and education that aims to interconnect all of the NRENs.

Thus, the East African universities are expected to be interconnected and to share resources as shown in Figure 1.2.



Source: Ubuntunet Alliance, 2009

Figure 1.2: Eastern and Southern Clusters of the Ubuntunet Regional Network

1.4 RESEARCH OBJECTIVES

This research had the following specific objectives:

6. Conduct a *diagnostic* assessment of overall e-readiness of 50 universities in the five East African countries of Kenya, Uganda, Tanzania, Rwanda and Burundi, with a particular focus on the use of ICT for teaching, learning, and research.
7. Develop and disseminate generic roadmaps for accession of universities to stage 4 of e-readiness, which is the highest state of readiness to use ICT, according the 2008 staging framework [Kashorda and Waema, 2008].

8. Develop institutional roadmaps for accession to stage 4 of e-readiness in 17 indicators. The would include building the capacity for the ICT leadership in 10 universities selected on a competitive basis.
9. Identify and study at least two innovative projects that demonstrate the impact of ICT on learning outcomes in any degree program offered by universities in East Africa that are committed to developing institutional roadmaps.
10. Disseminate research findings in each of the five East African countries, in international conferences and refereed journals.

This report contains the outcomes of objective 1 (e-readiness survey) as well as the generic roadmaps component of objective 2.

1.5 ASSESSMENT FRAMEWORK AND KEY RESEARCH FINDINGS

The assessment framework used in the 2008 survey was derived from an e-readiness assessment tool originally developed by the Center for International Development at Harvard University (http://www.readinessguide.org). This is the same assessment framework used in the 2006 e-readiness survey of Kenyan Higher Education Institutions [Kashorda, 2007] but with minor modifications. The framework contained 17 indicators grouped into the following five categories:

(i) Network access (4 indicators–information infrastructure, Internet availability, Internet affordability, network speed and quality)

(ii) Networked campus (2 indicators–network environment, e-campus)

(iii) Networked learning (4 indicators–enhancing education with ICTs, developing the ICT workforce, ICT research and innovation, ICTs in libraries)

(iv) Networked society (4 indicators–people and organizations online, locally relevant content, ICTs in everyday life, ICTs in the workplace)

(v) Institutional ICT strategy (3 indicators–ICT strategy, ICT financing, ICT human capacity)

The framework is diagnostic and stages each of the 17 indicators on a scale of 1 to 4, where 1 represents unpreparedness and 4 the highest degree of readiness. The staging for the 17 indicators was derived from the average of up to 88 sub-indicators similarly staged on a scale of 1 to 4 using the hard facts and perceptions data collected from the 48 universities surveyed. Using a diagnostic e-readiness framework makes it easier for the results to be used to develop an accession strategy to higher stages for each indicator.

Similar to the 2006 e-readiness survey, 15 strategic sub-indicators were also staged. The use of strategic sub-indicators means that universities could monitor a selected set of indicators on an annual basis. However, this report has identified a subset of five strategic sub-indicators that could be monitored at the corporate level by senior leadership at the universities.

The detailed questionnaires used to collect data were:

- A hard facts questionnaire that was completed by heads of ICT and other senior university administrators such as finance managers and academic registrars.

- A perceptions questionnaire (field data) that was filled by students and staff in each of the 53 universities surveyed.

The questionnaires were administered to a statistically significant sample in each of the 53 universities surveyed. The total sample was 1,253 faculty members, 1,092 non-teaching staff and 24,889 students. A total of 27,234 questionnaires were successfully completed in the five countries. All the data (hard facts and survey data) was entered into a Web-based database by students from the different universities (see: http://eready.kenet.or.ke) and is available to each of the universities.

The survey analyzed the results for each of the five categories of indicators and for each of the 53 universities surveyed. However, only 48 universities were used in the aggregated analysis for the reasons explained in Chapter 3. The detailed results for each of the institutions are not presented in this report but will be presented to any institution that plans to use them for ICT strategic planning. A similar approach was used to disseminate the results of the 2006 survey.

Figure 1.3 summarizes the results of the study by presenting the average stage for each of the 17 indicators in a radar diagram. On average, universities in the survey were at stage 2.0 and above in 10 out of the 17 indicators. However, they only achieved stage 3.0 in one indicator for locally relevant content and stage 2.5 and above in only four of the 17 indicators. This implies that accession would be more dependant on institutional ICT strategy category than the other categories of indicators. This will therefore be the main focus during the accession phase of this project.

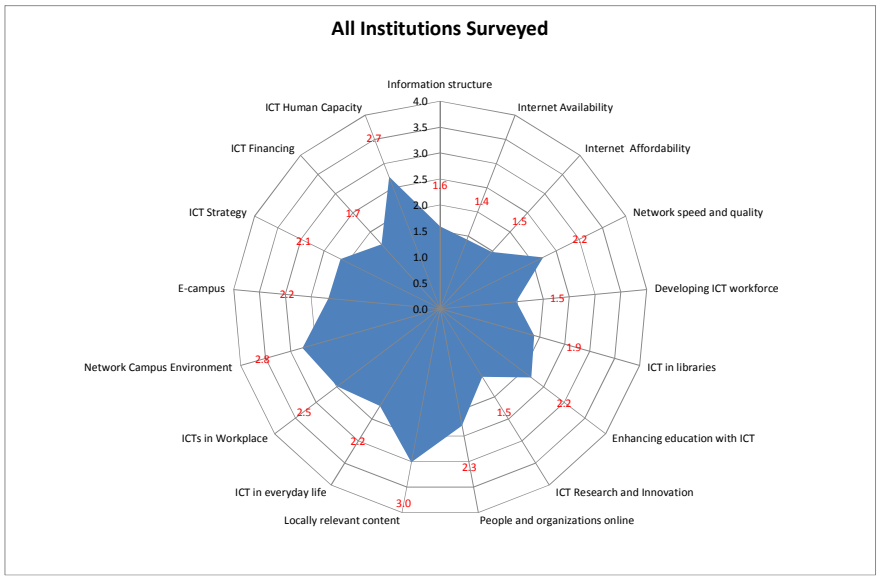


Figure 1.3: Average staging for 17 indicators for East African universities

As in 2006, this study analyzed the performance of universities in the 15 strategic sub-indicators. The results show that overall nine of the 15 sub-indicators were below stage 2.0 as shown in Figure 1.4. Thus, universities in East Africa were not ready for large-scale and transformational

use of ICT in teaching, learning, and research. In fact, the research suggested that focus in accession of the ICT strategy indicator to higher stages would have a more significant change in the networked learning category of indicator than simply increasing the Internet bandwidth or even the PC ratio staging.

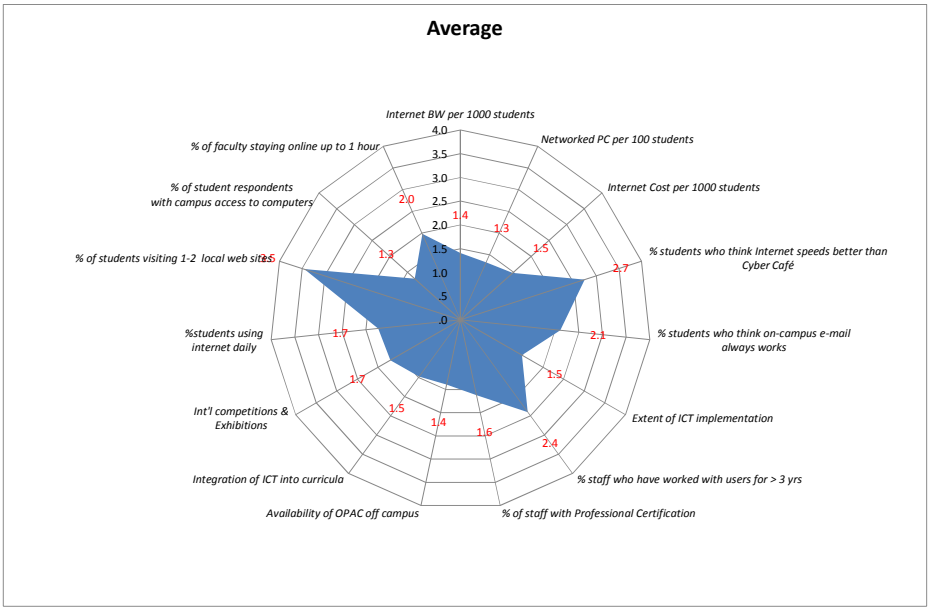


Figure 1.4: Average stages for 15 strategic indicators for all East African universities

This research also analyzed data for five different size categories of universities, categorized as small (less than 2,500 students), medium (2,500 – 5,000), large (5,000-20,000) and very large universities (over 20,000 students). The results suggested that size mattered but the reasons why it mattered were unclear. While the researchers expected small universities to adopt ICT faster, the results showed that it was the very large and well-established universities that were more effectively transforming learning using ICT, as measured by their higher staging in networked learning category of indicators.

However, one of the weaknesses of the data set used to stage the networked learning indicators was the fact that it was not normalized. For example, the researchers collected data on Master's and PhD degree programs that are offered by the very large universities but not the throughput of the programs. Similarly, the percentage of ICT students participating in exhibitions could not be quantified because a Yes/No question was used. The survey also did not count the fraction of on-line courses offered as a percentage of the total number of courses offered. The second phase of this research project will probably reveal some of the reasons why size seemed to matter.

1.6 ORGANIZATION OF THE REPORT

This report is organized into three parts. Part 1 contains is the introduction and methodology. It contains Chapter 1 (Introduction) and Chapter 2 (Methodology and Staging Framework), and Chapter 3 (Data Collection and Analysis Framework). Part 2 is the Staging Results and Analysis

part and contains five chapters (Chapter 4 – 8). Each of the chapters focuses on the results for each category of indicators. Part 3 is the Conclusions and Generic Roadmaps section. It contains two chapters, namely, Chapter 9 (Summary Results and Strategic Indicators) and Chapter 10 which presents the generic roadmaps arising from our conclusions and recommendations.

2. METHODOLOGY AND STAGING FRAMEWORK

2.1 The CID e-readiness assessment tool

E-readiness assessment tools can be classified into two broad categories, as follows:

- E-economy readiness tools that focus on a nation's or communities readiness to exploit ICT for economic development (i.e., to take part in the digital economy).
- E-society readiness tools that measure the ability of the overall society to benefit from ICTs. (Bridges, 2001, http://www.bridges.org/ereadiness/tools.html)

In general, e-society tools can also assess the readiness of a nation or community to participate in the digital economy. The CID e-readiness tool, appropriately titled "Readiness for the Networked World–A Guide for Developing Countries," is an example of an e-society tool (CID, 2001). It was developed by the Information Technology Group at the Center for International Development (CID), Harvard University. It is a *diagnostic* tool that was used in the first e-readiness assessment of Kenya in 2002 (Waema and Kashorda, 2002). However, it needed to be modified for use by the higher education community.

The CID "Readiness for the Networked World" tool monitors 19 indicators grouped into the following 5 categories:

(i) Network access (6 access indicators–information infrastructure, Internet availability, Internet affordability, network speed and quality, hardware and software, service and support)

(ii) Networked learning (3 Internet usage in education indicators–schools access to ICTs, enhancing education with ICTs, developing the ICT workforce)

(iii) Networked society (4 indicators–people and organizations online, locally relevant content, ICT in everyday life, ICTs at the workplace)

(iv) Networked economy (4 indicators–ICT employment opportunities, B2C electronic commerce, B2B electronic commerce, e-government)

(v) Network policy (2 indicators–telecommunications regulation, ICT trade policy)

Each indicator is staged on a scale of 1 (not ready) to 4 (completely ready) using both hard facts data (e.g., PCs per 100 employees, telephones per 100 employees, etc.) and perception or "soft" data collected using field-based surveys. Hard facts data could be obtained from ICT professionals in each institution. Although the CID assessment tool provides a general basis for staging the different indicators, this survey modified the tool by introducing new categories of indicators, and sub-indicators appropriate for universities. The new sub-indicators were especially useful in interpreting data and staging each of the 17 indicators. The sub-indicators were derived specifically for the higher education community in Kenya and were not specified by the CID tool.

2.2 Adaptation of the CID tool for assessing East African universities

The original CID tool specified 19 indicators. However, some of the indicators in the CID tool, such as ICT trade policy, telecommunications regulation and networked economy, were not

relevant for higher education and they were eliminated. Six new indicators were introduced and renamed into two categories. These were networked learning indicators (i.e., ICT in research and innovation and ICTs in libraries) which were motivated by the guidelines for institutional self-assessment developed for the Association for African Universities (AAU) (AAU, 2000). The resulting set of 17 relevant indicators was grouped into five categories as follows:

(i) Network access (4 indicators–information infrastructure, Internet availability, Internet affordability, network speed and quality)

(ii) Networked campus (2 indicators–network environment, e-campus)

(iii) Networked learning (4 indicators–enhancing education with ICTs, developing the ICT workforce, ICT research and innovation, ICTs in libraries)

(iv) Networked society (4 indicators–people and organizations online, locally relevant content, ICTs in everyday life, ICTs in the workplace)

(v) Institutional ICT strategy (3 indicators–ICT strategy, ICT financing, ICT human capacity)

These categories were similar to those used in the 2006 Kenyan survey. However, the category of institutional ICT policy and strategy used in the 2006 survey was renamed institutional ICT strategy because the indicators did not address ICT policy issues.

To stage each of the 17 indicators, minor changes were made to the staging framework originally developed in 2007, in order to simplify the staging process [Kashorda, 2007]. The following section briefly describes the 2007 staging framework and highlights the minor changes made in the 2008 assessment framework.

2.2.1 Network access category of indicators

The *information infrastructure* indicator is derived by measuring two sub-indicators, namely, the external and internal teledensity. The external teledensity was measured by the number of external exchange lines terminated at the PBX (either mobile or fixed lines) per 100 employees. The internal teledensity is the number of PBX telephone extensions per 100 employees. The information infrastructure therefore measured access to telephones by university staff. Data for staging was obtained using from the hard facts questionnaires.

The *Internet availability* indicator was measured using three sub-indicators, namely the uplink bandwidth per 1000 students, the download bandwidth per 1000 students, and the networked PCs per 100 students. Data for calculating the values of the sub-indicators was obtained from the hard facts questionnaires. The research study determined the range of values for each sub-indicator based on researchers' experience with Kenyan institutions but took into account internationally comparable values.

Internet affordability attempts to determine whether institutions find Internet access expensive. In the 2006 survey, it was measured using two sub-indicators, namely, Internet bandwidth costs as a percentage of the total expenditure of the institution and the cost per 1000 students. A high percentage indicated that institutions spent a large proportion of their budget on Internet access and therefore its Internet bandwidth was not affordable. Universities that were spending more per 1000 students were assessed to be at a lower stage than those spending less per 1000 students in absolute terms. Thus, a higher stage meant the institution was spending relatively little on

Internet bandwidth (i.e., bandwidth was still affordable). This was counter-intuitive because an institution at a higher stage was supposed to be in state of higher readiness.

Consequently, the 2008 survey modified the 2006 staging framework so that stage 4 reflected higher stage of readiness. Only one sub-indicator was used to measure Internet affordability, namely, Internet bandwidth cost per 1000 students. Universities that were spending more were also assessed to be at a higher stage than institutions spending less. That is, universities that were spending little needed to increase their budgets in order to move to a higher stage in the Internet affordability indicator. This indicator was changed to make it more relevant. The ranges for the staging were determined empirically based on the data collected in the 2006 study and the average cost of Internet bandwidth in East African countries without subsidy by donors or governments (e.g., the government of Rwanda subsidizes Internet bandwidth). Sub-indicators were measured using the hard facts questionnaire data.

As an example, universities spending less than US$ 13,000 per year on Internet bandwidth were considered to be at stage 1 while universities spending more than US$ 37,000 per year were assessed to be at stage 4. The 2006 survey recommended a target of 1 Mb/s Internet bandwidth per 1000 students. Although 1 Mb/s bandwidth per 1000 students may seem low by developed world's standards, but higher figures would not be affordable to most EA universities' at current bandwidth costs. For example, 1 Mb/s Internet bandwidth translates to about US$ 25,000 per annum per 1000 students assuming an average Internet cost of US$ 2,100 per Mb/s per month (this was the average in East Africa in the 2008 survey as described in Chapter 4 of this report). This was the upper limit of stage 2 of the Internet affordability indicator in this framework. However, if the undersea fiber bandwidth were to reduce the average cost to US$ 500 per Mb/s per month, universities at stage 2 would move to stage 4 and the absolute figures would be revised accordingly.

The *Network speed and quality* indicator was measured using the perceptions survey data. Five sub-indicators were used to measure this indicator. Two of the sub-indicators measured the percentage of student and faculty respondents who thought campus e-mail always worked. A percentage greater than 50% was considered to be at stage 4 and a percent less than 10% was considered to be at stage 1. Another two sub-indicators measured the percentage of students and faculty who thought campus Internet speed was better than cyber cafés. A percentage greater than 50% put the institution at stage 4 while an indicator less than 10% was at stage 1. The fifth indicator measured the percentage of faculty who considered Internet speed on their campus to be slowing down their work. Less than 25% was considered to be at stage 4 while more than 75% was assessed to be at stage 1. Determination of the stages was derived from this new staging framework [Kashorda and Waema, 2008].

2.2.2. Networked campus category of indicators

The networked campus category of indicators is closely related to the network access indicators. For example the network environment indicator measures both the ICT power supply environment and the security for ICT equipment and software. ICT power supply and security are big challenges for most campus networks and systems and determine availability of ICT on campus. To be at stage 4 in this indicator means that an institution is already at stage 4 in the ICT power supply sub-indicators as well as ICT security sub-indicators.

The second indicator of the networked campus indicator category is the electronic campus or e-campus indicator. This indicator measures ICT usage for internal as well as external operations. A stage 4 campus would have fully automated internal operations and would also be using ICT to interact with suppliers and students. This means that the campus and associated departments would have interactive and transactional websites that are regularly updated. Data for staging this was obtained from the hard facts questionnaires.

2.2.3 Networked learning category of indicators

Table 2.1 shows the indicators and the sub-indicators in this category of indicators and the main purpose for the indicators.

Table 2.1 – Networked learning indicators

Indicator	**Key Sub-indicators**	**Purpose**
Developing ICT workforce	% of ICT technical staff with professional certification	Four sub-indicators measure the extent the institution is preparing and training its ICT workforce. At stage 4, the institution has proficient users of ICT who are regularly trained.
	% of employees trained on productivity tools	
	% of employees receiving internal e-learning training	
	% of ICT staff who have received network administration training	
ICT in libraries	On-campus OPAC	Seven sub-indicators measure the degree of automation of library and usage of ICT for back-end library operations. At stage 4, the library is fully automated (front-end and bank-end operations) with support and training of users. All seven sub-indicators staged using Yes/No responses on the hard facts rather than extent of usage.
	Off-campus OPAC	
	Availability of multimedia centers in libraries	
	Availability of Internet databases	
	Information literacy training	
	Local digital content (digital library)	
	Use of e-mail updates to library holdings	
Enhancing education with ICT	Availability of educational software	Five sub-indicators used to derive the indicator stage. These were all measured using Yes/No responses by ICT directors and not quantitative data. This indicator measures the integration of ICT in curricula and the readiness of institution to offer e-learning courses and use ICT in class. Stage 4 institutions have integrated the ICT in curricula and ICT used in all stages of learning and projects (even non-ICT projects)
	Availability of course management system (Moodle, WebCT)	
	Integration of ICT in curricula	
	Use of ICT in the classroom	
	Use of ICT in student projects	
ICT research and	ICT undergraduate degree program offered	This indicator measures ICT research and innovations. The sub-indicators

Indicator	Key Sub-indicators	Purpose
innovation	ICT Master's degree program offered	selected as indirect measures of ICT research and innovations. For example, Master's and doctoral ICT programs offered increase research output of institutions. Stage 4 institutions have ICT doctoral degree programs and students participate in ICT exhibitions and competitions. No quantitative data collected in survey only Yes/No responses.
	ICT PhD degree program	
	Participation in international design projects and exhibitions (e.g., IEEE exhibitions)	

2.2.4. Networked society category of indicators

The networked society category of indicators measures the readiness of the community to use ICT for teaching, learning, research, and management (or administration). Data for staging this category of indicators was obtained from the analysis of the data collected using the perceptions questionnaire. Table 2.2 summarizes the indicators and the associated sub-indicators used for staging.

Table 2.2: Networked society category of indicators

Indicator	Key Sub-indicator	Purpose
People and organizations online	% of respondent who have never used the Internet	Indicator measures the intensity of use of on-line resources and what they need the Internet for. Stage 4 means less than 1% have never used the Internet, over 75% of students and faculty use the Internet daily and all students and faculty have e-mail addresses.
	% of respondents who consider Internet most important for e-mail	
	% of students who consider Internet most important for academic work	
	% of faculty using Internet daily	
	% of students using Internet daily	
	% of students who think institutional website interactive	
	% of students who do know about their institutional website	
	% of students with e-mail accounts	
Locally relevant content	% of students visiting 1-2 local websites	Indicator measures availability of websites with local content. It could be academic, news or entertainment. It also measures the degree to which users are attracted to the locally relevant websites. At stage 4, students,
	% of students visiting 1-2 local websites	
	% of students and faculty looking for academic information from Internet	

Indicator	Key Sub-indicator	Purpose
	% students looking for news/entertainment	faculty and staff have access to relevant local content
	% of students and faculty visiting Web portals with Kenyan information	
ICTs in everyday life	% of students with campus access to computers	This indicator measures access and usage of ICT on- and off-campus.
	% of faculty with campus access to computers	
	% of students whose main access to computers/Internet is cyber café	
	% of students with home access to computers	
	% of faculty with home access to PC	
	% of students and faculty using computers for e-mail/Internet	
	% of students and faculty using PC for word processing	
ICTs in the workplace	% of faculty using Internet for academic work	Data obtained from staff (academic and non-academic staff). Measures readiness and usage of ICTs at work (e-mail, ERPs, e-learning platform, Productivity tools). This was collected from the perception survey
	% of faculty using e-mail for internal communications	
	% of administrative staff using e-mail for internal communications	
	% of faculty who access Internet from office	
	% of faculty staying on-line for more than 1 hour	

2.2.5 Institutional ICT strategy indicatorsThe institutional ICT strategy indicator is composed of three indicator categories, namely, ICT strategy, ICT financing, and ICT human capacity. The ICT strategy indicator was measured using five sub-indicators that were used to assess the status of the head of ICT (title, level of reporting), the champion for ICT (stage 4 means position reports to VC, DVC or equivalent), and the degree of ICT strategy implementation and alignment to corporate strategy. Data was obtained from the hard facts questionnaires completed by the heads of ICT at the universities.

The second indicator of this category is ICT financing. This measures the extent to which an institution allocates sufficient funding for ICT. The framework defined 3 sub-indicators as follows:

(i) Percentage of Internet bandwidth costs to the total institution or campus expenditure

(ii) Percentage of ICT budget to total institutional budget
(iii) Total annual ICT software and hardware

Data on ICT total expenditures was not available for most universities and this indicator was staged using only the percentage of Internet bandwidth costs to the total institution expenditure. However, even data on total university expenditure was not easily available and most of the universities did not have annual reports with financial data. This lack of transparency in most public universities in East Africa was surprising and the underlying reasons should be established in future research on governance in universities.

The final category is ICT human capacity measured using the following four sub-indicators:

(i) Highest qualification of head of ICT (Relevant PhD in business or IT was placed at stage 4)
(ii) Relevant experience in business and IT for the head of ICT (5 years was placed at stage 4)
(iii) Percentage of ICT staff with more than three years experience in user support
(iv) Frequency of ICT staff skills upgrade through certification and/or training

Thus, the indicator measures the degree to which an institution has competent and well trained ICT professional and support staff. The ICT staff should be qualified in networking technologies.

To achieve stage 4 of this dimension, the institution's ICT staff should have both business and ICT skills and experience, with the head of ICT having business skills and experience. In addition, ICT professional staff should have relevant ICT degrees, technical skills of professional ICT staff should be upgraded regularly and there should be high retention of professional ICT staff. Data for staging this category of indicators was obtained from hard facts questionnaires.

2.3 Strategic ICT sub-indicators

The staging framework used 88 sub-indicators to stage each of the 17 indicators. Although the 17 indicators were necessary for assessing the overall readiness of the universities, the 2006 study defined a set of 15 sub-indicators that could easily be monitored by the heads of institutions. These sub-indicators included the number of PCs per 100 students and the Internet bandwidth per 1000 students. These sub-indicators were referred to as strategic sub-indicators because they could easily be included as institutional performance indicators in institutional strategic plans. The 2008 e-readiness survey also adopted the 15 strategic sub-indicators for ease of comparison with the 2006 survey results.

Table 2.3 shows the 15 sub-indicators that were identified in the 2006 study. The 2008 study recommends the following five indicators that could be tracked by Vice Chancellors or senior management:

f. Internet bandwidth cost per 1000 students
g. Internet bandwidth per 1000 students
h. PCs per 100 students
i. Extent of ICT strategy implementation
j. Integration of ICT in curricula

The hard facts and perceptions questionnaires developed in the 2006 survey were revised to eliminate questions that were considered unnecessary or difficult in the 2006 survey. It was also

necessary to ensure that the questionnaires were appropriate to all the East African countries (for example US instead of Kenyan currency was used). The questionnaire for participating universities in Burundi were translated into French. Chapter 3 describes how the data was collected and the analysis framework adopted based on the staging framework.

Table 2.3 shows the strategic sub- indicators.

Category of indicators	Indicators	ICT Strategic Sub-indicators	Comments
A. Networked access	Internet availability	1. Internet bandwidth per 1000 students	▪ Both absolute value and staged value needs to be used. ▪ Both uplink and downlink Internet bandwidth used in the calculation and staging.
		2. Networked PCs per 100 students	▪ Sub-indicator data easily available and should be used to determine level of ICT investments
	Internet affordability	3. % of Internet bandwidth cost to total campus expenditure	▪ Sub-indicator easy to calculate and measure if institution Internet bandwidth spending aligned to strategic importance.
	Network speed and quality	4. % of students who think network speed better than cyber café	▪ This indicators require that institutions conduct satisfaction surveys regularly ▪ Perception survey data
		5. % of students who think on-campus e-mail always works	▪ Perception survey data
B. Networked learning	Developing the ICT workforce	6. % of ICT staff with professional certification	▪ Measures the competence of the ICT professional staff; higher chance they will train other users
	ICT in libraries	7. Availability of OPAC off-campus	▪ This is necessary for e-learning and digital library services
	Enhancing education with ICT	8. Integration of ICT in curricula	▪ Institutional leadership can monitor this indicator
	ICT research and innovation	9. Student participation in international ICT-based exhibitions and competitions	▪ Measurable indicator of quality and innovation of ICT degree programs offered.
C. Networked society	People and organizations online	10. % of students using Internet daily	▪ This depends on integration of ICT in curricula, access, and readiness of students
	Locally relevant content	11. % of students visiting 1-2 local websites	▪ This is easily monitored by the universities; however, necessary to conduct field survey of the
	ICTs in everyday life	12. 14. % of students whose main access to computers is on campus	▪ This is perceptions indicator not captured elsewhere
	ICTs in the workplace	13. % of faculty staying on-line for more than 1 hour per day	▪ This could be monitored on campus if most faculty access Internet at workplace; field survey necessary
D. Institutional policy and strategy	ICT strategy	14. % of ICT strategy implementation	▪ ICT head needs to monitor and report ICT strategy implementation; Institution head gets quarterly reports
	ICT human	15. % of ICT staff	▪ This is a measure of retention,

Category of indicators	Indicators	ICT Strategic Sub-indicators	Comments
	capacity	worked for > 3 years (retention)	important for quality ICT services. Easy to measure for different categories of ICT staff (e.g., network engineers, Database administrators)

3. DATA COLLECTION AND DATA ANALYSIS

3.1 Selection of participating universities

To conduct an e-readiness survey of 50 universities, the lead researchers based in Kenya, decided to work through National Research and Education Networks (NRENs) in the participating countries, except for Burundi where the NREN had not yet been established. Associate researchers from each of the four countries were identified through NRENs and became part of the project. Initially, Burundi was to be covered by Rwanda, but a contact associate researcher in that country was later identified. Appendix 1 contains the names and affiliations of the associate researchers.

The universities were invited to apply to participate in the project through advertisements in newspapers in Kenya, Tanzania, and Uganda, as well as by e-mail sent to Vice-Chancellors (VCs) of all universities in the region. In Burundi and Rwanda, the associate researchers contacted the VCs directly by telephone and through an official letter from the research team leader. In addition, the research teams made presentations on the project at Vice Chancellors' forums in Uganda and Tanzania. Universities indicating interest in participating in the project were then required to complete an application form giving basic data on their institutions, including student enrollment and number of staff. This data was used to calculate the sample sizes.

By the deadline for submission of application forms, 68 universities from all over East Africa had responded, and committed to providing the data required for the survey. Table 3.1 shows the number of universities that completed applications from each of the countries.

Table 3.1: Universities completing application forms per country

Country	Number of Universities
Burundi	6
Kenya	26
Rwanda	9
Tanzania	13
Uganda	14
Total	**68**

To limit the number of universities to 50, the following criteria were adopted:

1. Student population > 1000
2. Degree programs offered >=5
3. Science/technology degree programs (CS,EE,IS) >1
4. PCs per 100 students > 2
5. Internet bandwidth per 1000 students >= 128Kbps
6. Balance between private and public universities
7. Balance between urban and rural (outside capital city) universities
8. Most of the universities surveyed in 2006/2007 e-readiness survey were included

Using the above criteria, 53 universities were selected as follows: Burundi (5), Kenya (17), Rwanda (8), Tanzania (12) and Uganda (11). However, only 49 successfully completed the detailed hard facts questionnaire required for the e-readiness analysis. Although the Open University of Tanzania completed the hard facts questionnaire, it was excluded from the final e-

readiness analysis because the analysis tools assumed a campus-based university. Therefore only 48 universities were included in the detailed analysis although perception data for all 53 universities surveyed was entered into the database.

Total student enrollment for the participating 48 universities in the detailed analysis was 352,672, while the total number of full-time faculty members (i.e., academic teaching staff) was 13,147. However, the total number of employees was 38,536 as shown in Table 3.2.

Table 3.2: Demographic data for 48 universities surveyed

Country	Number of Institutions	Total students	Full time teaching staff	Total Staff
Kenya	17	162,319	722	1419
Rwanda	7	32,450	5528	21635
Tanzania	9	41,816	2960	6734
Uganda	10	95,550	2227	6183
Burundi	5	20,537	1610	2545
Total	**48**	**352,672**	**13,147**	**38,536**

Source: KENET 2008

3.2 Sampling method and sample sizes

Although this survey used similar data collection tools to those used in the 2006 e-readiness survey, the hard facts and a perceptions questionnaire tools were revised for clarity and for contextual relevance to the East African countries. The questionnaires used for Burundi were translated into French.

The hard facts questionnaires were completed by the heads of Information and Communications Technology (ICT) support units in consultation with other department heads (e.g., finance heads, academic registrars, and university librarians). On average, Kenyan universities took two weeks to complete the questionnaire while the others took about a month. Missing information was completed by calling the universities several times even after the hard facts questionnaires had been submitted. The delay in responding was mainly caused by lack of data in a single database and reluctance to disclose financial information. Moreover, most universities did not have annual reports that captured all the demographic data and financial expenditures for ICT. The key hard facts data therefore was collected over three months, from November 2008 to February 2009. All the universities were required to use 2008 data.

The sample sizes for perceptions questionnaires took into account the total population of students, faculty and staff. Table 3.3 shows the sample sizes for the five countries. The sample sizes were statistically significant for each country and for each university. The resulting confidence interval was about 1% with 95% confidence level.

Table 3.3: Sample sizes for different categories

	Occupation			
	faculty	admin staff	students	Total
Kenya	560	503	10,142	11,205
Uganda	330	199	7,523	8,052
Tanzania	311	287	4,035	4,633
Rwanda	45	84	2,713	2,842
Burundi	7	19	476	502
Total	1,253	1,092	24,889	27,234

The student and faculty sample population was also classified into eight broad categories as shown in Table 3.4. These were the same categories used for analysis in the 2006 e-readiness survey except for the new category of business or commerce that was included in the 2008 survey (in 2006, business students were included in the humanities category). Although this did affect the overall analysis, the data could be used to analyze the e-readiness of different academic areas.

Table 3.4: Sample size for different academic areas

	Gender		Total
Academic Areas	male	Female	
Human and Social Sciences	2098	1862	3960
Languages, Communication, Journalism	587	519	1106
Computing (IT, IS, CS CE)	2407	1306	3713
Engineering (Electrical, Mechanical, Civil)	1235	411	1646
Biological Sciences, Physical Sciences	978	637	1615
Education	1540	1414	2954
Medical Sciences	829	712	1541
Business or Commerce	2522	2281	4803
Other	1477	1171	2648
Not stated	733	648	1381
Total	**14406**	**10961**	**25367**

In all, 27,234 valid perception questionnaires were entered into the database compared to 8,159 in the 2006 survey. The large number of questionnaires was necessary to ensure that each of the 53 universities could be analyzed separately (i.e., the sample size was statistically significant for each university allowing for individual analysis as required by the research study). The majority (90%) of the respondents were students.

In sampling the students, there was an additional requirement for gender balance. The students' sample was also representative of the number of students in different years of study as shown in Table 3.5. However, overall, 43% of the respondents were female, which is consistent with the gender distribution of students in the region's universities.

Table 3.5: Students sample population by year of study

	Country				
	Kenya	**Uganda**	**Tanzania**	**Rwanda**	**Burundi**
First	2,221	1,804	908	501	65
Second	2,833	2,658	1,280	766	105
Third	2,742	2,552	1,336	809	191
Fourth	1,796	305	287	472	97
Fifth	270	16	81	76	8
Master's	125	58	63	40	0
Doctoral	6	2	3	2	0
Sixth	20	4	6	0	0
Total	**10,013**	**7,399**	**3,964**	**2,666**	**466**

One of the challenges of obtaining a random sample was the lack of student and staff data in electronic form. For example, the survey intended to sample the students and staff at random from an electronic list obtained from the academic registrars, but this was not possible. The research assistants therefore used ICT academic and support departments to select students from different categories. The student data enumerators or data collectors were identified either by ICT faculty or by the ICT department staff. The enumerators included students from each of the categories of students, excluding graduate students, and were trained by the research assistants and given guidelines for selecting students in the different categories. The data collection guidelines and the fact the enumerators represented different categories of students ensured that the resulting data samples were random.

3.3 Data collection and entry

The hard facts and perceptions questionnaires were directed questionnaires, similar to the decentralized process used in the 2006 survey. The following procedure was used:

a. The e-readiness survey coordinator recruited and trained the Kenyan research assistants from participating universities who were then allocated to the different participating universities.
b. For, Burundi, Rwanda, Tanzania, and Uganda, the coordinator worked with the respective country associate researchers to select and train the research assistants who would then coordinate collection of data from the various universities. The associate researchers were all members of existing NRENs secretariats or the NRENs being formed (e.g., in Burundi).
c. Each research assistant then recruited and trained the student enumerators from each participating university using the guidelines provided. These enumerators then administered the perception survey questionnaires to students, faculty, and staff in their respective universities.
d. The research assistants were responsible for collecting the hard facts data, which was the most challenging part of the exercise.
e. All of questionnaires in the other countries were then sent by the research assistants to their respective associate researchers who then sent them back to Kenya via courier.

A total of 27,234 questionnaires were successfully completed in each of the five countries (see Table 3.2 and Table 3.3).

Data entry was done using the Web-based data entry interface (http://eready.kenet.or.ke) by students in a distributed fashion at different universities in Kenya and at the KENET headquarters. The data entry exercise was supervised by the research assistants. Quality assurance involved sampling 10% of the questionnaires entered by independent data entry students. In total, the data collection and data entry exercise included about 1,100 students from the 53 participating universities. Appendix 3 contains the list of research assistants and their institutional affiliations.

All of the hard facts and valid perceptions data was entered into the on-line database and then exported to SPSS for analysis. The database is available to each institution at http://eready.kenet.or.ke .

3.4 Data analysis

The detailed staging framework described in Section 2 guided the analysis of the data. Data from the database was first exported into SPSS tool that was used to analyze the data. Results of the analysis and staging are contained in Chapters 4 to 8. The results were presented in tables, charts, and radar diagrams. The analysis was done at both country level and university level. The detailed results for each university are available to each of the universities (ICT directors or their assigns will have the institutional passwords).

The staging framework developed in this research study was used to calculate the values of the different sub-indicators. For example, a sub-indicator of PCs per 100 students was calculated from the data. This value was then converted to a staged value in the range 1 to 4 as explained in Chapter 2. The staging framework was used by the researchers to manually assign a value of 1 to 4. Once the stage for each sub-indicator (there were 88 sub-indicators) was established, the rest of the process of calculating averages and generating charts was automated. Chapters 4 to 9 describe the results for each category of indicators.

PART 2: FINDINGS AND STAGING ANALYSIS

4 NETWORK ACCESS

4.1. Overall staging for Network Access category of indicators

The network access category of indicators included the following four indicators:

(i) Information infrastructure (in the campus)
(ii) Internet availability (by the universities)
(iii) Internet affordability (by the universities)
(iv) Network speed and quality (as perceived by users on campus)

The information infrastructure was measured using two sub-indicators, namely, internal teledensity and external teledensity. It measured the availability of voice communication telephone extensions to employees of the university (faculty and staff) as well as access to external telephone lines (mobile or fixed) from the universities' PBX .

The Internet availability indicator depended on availability of networked computers as well the international bandwidth purchased. The sub-indicators therefore included PCs per 100 students and Internet bandwidth per 1000 students (both uplink and downlink measured separately). Each of the sub-indicators was staged and the unweighted average used to derive the stage for the indicator.

Stage 2 for Internet availability was achieved when the sub-indicator was 10 PCs per 100 students and the Internet bandwidth ratio sub-indicator was 1 Mb/s per 1000 students. This was the target recommended in the 2006 survey. Stage 2 was attained by PC to student ratio range of 1:5 to 1:20 and total bandwidth range of 640 Kb/s to 2.5 Mb/s according to this staging framework [Kashorda and Waema, 2008].

Figure 4.1 shows the staging of the network access category of indicators. Overall, the universities were at stage 1.4 for Internet availability and at stage 1.6 for information infrastructure indicators, implying that the universities neither have adequate telephones for staff nor Internet access for students and staff.

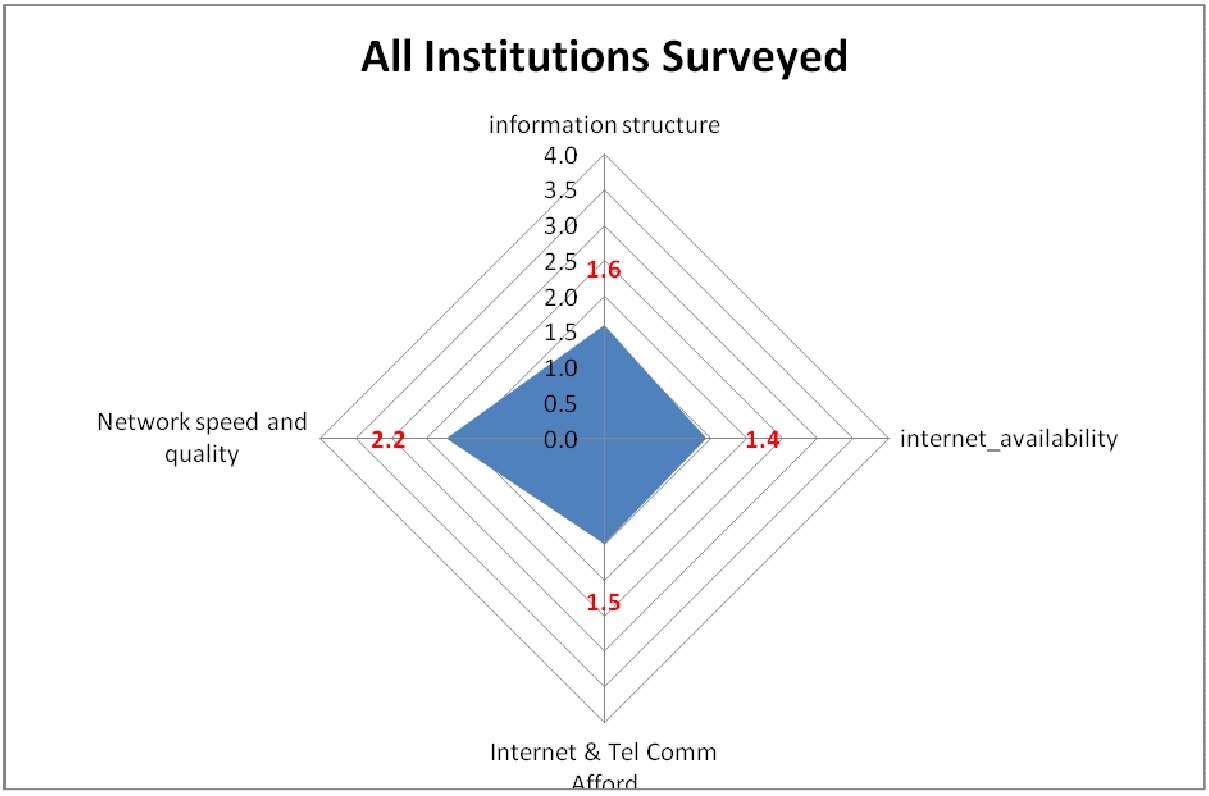


Figure 4.1: Overall staging of network access category of indicators

The overall unweighted average network access stage for the universities is shown in Figure 4.2. It indicates that on average, the universities were at stage 2 or below. The average for Kenya was stage 2.0 compared to stage 1.9 in the 2006 e-readiness survey. This means that Internet availability measured by PCs per 100 students and bandwidth per 1000 students was still limited as shown in Table 4.1. The table shows that the average PC ratio was 5.3 PCs per 100 students and the bandwidth was 430 kb/s per 1000 students. These ratios were below the target of 10 PCs per 100 students and bandwidth of 1,000 kb/s per 1000 students set in the 2006 survey. Universities therefore still need to continue investing in the campus networks in order to increase both PC and Internet bandwidth ratios.

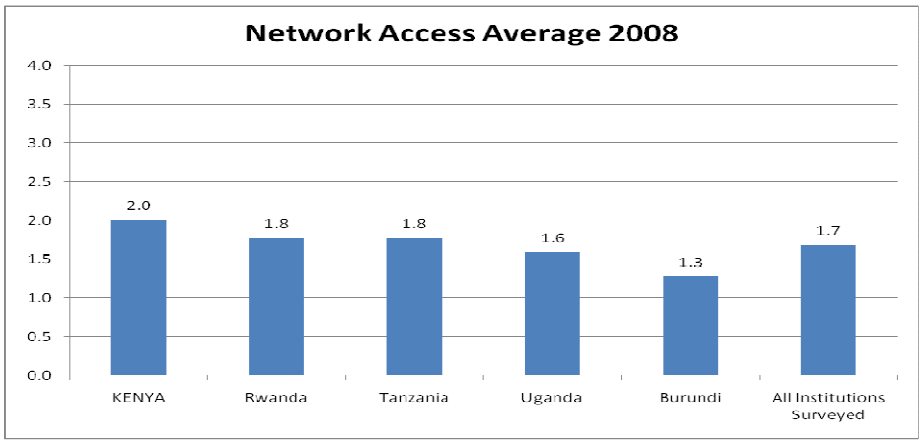


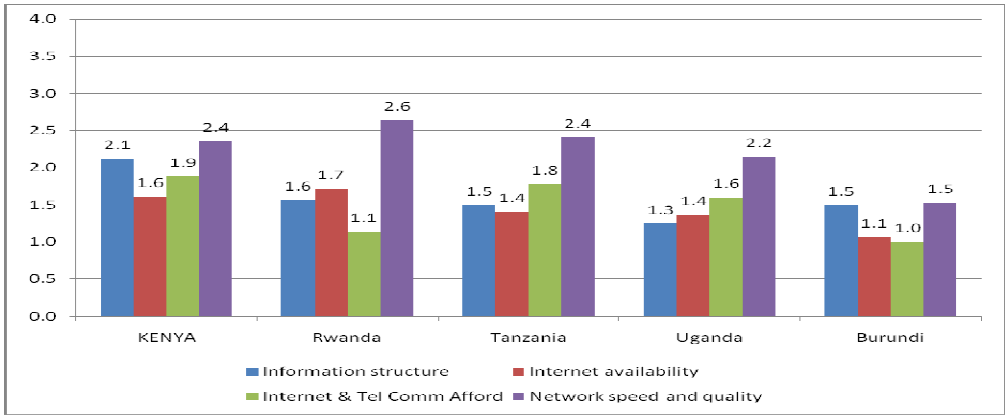
Figure 4.2: Network access unweighted average stages for universities in the five East African countries

Table 4.1: Demographic data and Internet availability sub-indicators in universities surveyed

Country	Number of Institutions	Total students	Total students PCs	Total Bandwidth	Bandwidth per 1000 students	PCs per 100 students
Burundi	5	20,537	308	2,368	115.3	1.5
Kenya	17	162,319	8,544	70,764	436	5.3
Rwanda	7	32,450	2,367	31,512	971.1	7.3
Tanzania	9	41,816	1,130	17,240	412.3	2.7
Uganda	10	95,550	6,489	29,716	311	6.8
Total	48	352,672	18,838	151,600	429.9	5.3

Source: KENET 2008

Figure 4.3 shows the staging for the four indicators of network access for the five countries. The network speed and quality perception is higher than other indicators, including Internet availability. It seems that a small increase in Internet availability translates into a high stage in network speed and quality perception. This is an area that requires further study and analysis.



Source: KENET 2008

Figure 4.3: Network access indicator average stages for universities in East Africa

The weighted average cost of satellite bandwidth in East Africa was about US$ 2,100 per Mb/s per month when purchased by individual universities. Consequently, the 48 universities in the survey purchased about 152 Mb/s for the 352,000 students that were enrolled in 2008. However, this price could be reduced to under US$ 1800 per Mb/s if they were organized into a consortium. For example, Kenyan universities signed a contract in December 2008 to purchase international satellite bandwidth for about US$ 1700 per Mb/s for 215 Mb/s through the KENET consortium of 55 Kenyan higher education institutions. The capacity of 215 Mb/s was higher than the total bandwidth of 152 Mb/s that was purchased by all the 48 East African universities surveyed from October to December 2008 (see Table 4.2). The weighted average price of US$ 2,100 was calculated using the actual cost to universities and did not take into account any bandwidth subsidies (e.g., some universities in Rwanda received a subsidy of US$ 2,500 per Mb/s per month bringing the average price to about US$ 1,000 as shown in Table 4.2). Invariably, with the installation of optical fiber in the eastern Africa region, the total bandwidth will increase dramatically and most universities are expected to achieve the target of 1 Mb/s per 1000 students' ratio recommended by the 2006 survey of Kenyan universities.

Table 4.2: Internet bandwidth purchased and average costs per country

Country	Total bandwidth purchased universities (Mb/s)	Total cost (US$)	Weighted average Cost per Mb/s per month
Burundi	2.9	35,100	1,015.6
Kenya	70.8	1,976,670	2,327.6
Rwanda	31.5	378,000	999.6
Tanzania	17.2	439,700	2,125.4
Uganda	29.7	1,015,636	2,848.2
Total	152.1	3,845,106	2,107.0

Source: KENET 2008

Although availability of undersea bandwidth expected in July or August 2009, will lower cost and increase quality of bandwidth, a key challenge for universities outside big cities will be the relatively high cost of distributing the bandwidth using leased lines, and the lack of high quality optical fiber links to the university campuses, from poorly developed national Internet infrastructure . In Kenya however, the KENET consortium signed a contract in November 2008 to purchase leased line capacity at US $160 per 10 Mb/s of last mile optical fiber links for all universities in the country, including those outside urban areas. Rwanda, Uganda, and Tanzania are currently building national optical fiber networks that will lower the price of optical fiber leased line bandwidth in the future for most of their universities in these countries.

4.1.1 Information infrastructure

A score of 1.6 on this indicator means that the internal teledensity was under 50% and the external teledensity was under 10%. However, 70% of the faculty respondents reported that they had access to a telephone extension in their office, indicating that universities ensured that faculty members had improved access to telephones. Overall, universities in East Africa, especially public universities in Kenya, have many non-teaching staff, as shown in Table 4.3, that do not contribute directly to the education mission and therefore lower this ratio.

Table 4.3: University staff in the East African countries

Country	Full time teaching staff	Part time staff	Non academic staff	Total Staff
Burundi	722	320	377	1419
Kenya	5528	988	15119	21635
Tanzania	2960	297	3477	6734
Uganda	2227	1023	2933	6183
Rwanda	1610	57	878	2545

4.1.2 Internet availability

The Internet availability indicator was at Stage 1.5, suggesting that most universities were providing limited Internet access to students. For example, Table 4.1 shows that on average

universities were providing 430 kb/s per 1000 students. Such bandwidth was only useful for campus-based e-mail or for use by selected departments. Stage 4 in this indicator would require at least 4 Mb/s of download bandwidth per 1000 students and 1 Mb/s of uplink bandwidth. Universities will therefore need to increase their bandwidth purchases and the corresponding Internet budgets.

Internet access on campus also required availability of networked PCs in labs and offices. This was measured using the sub-indicator of PCs per 100 students. Table 4.1 shows that the average PCs per 100 students was only 5.3 for universities in the region. Universities in Rwanda had the highest PC ratio at 7.3 PCs per 100 students. However, this was still below the target of 10 PCs per 100 students recommended in the 2006 e-readiness survey.

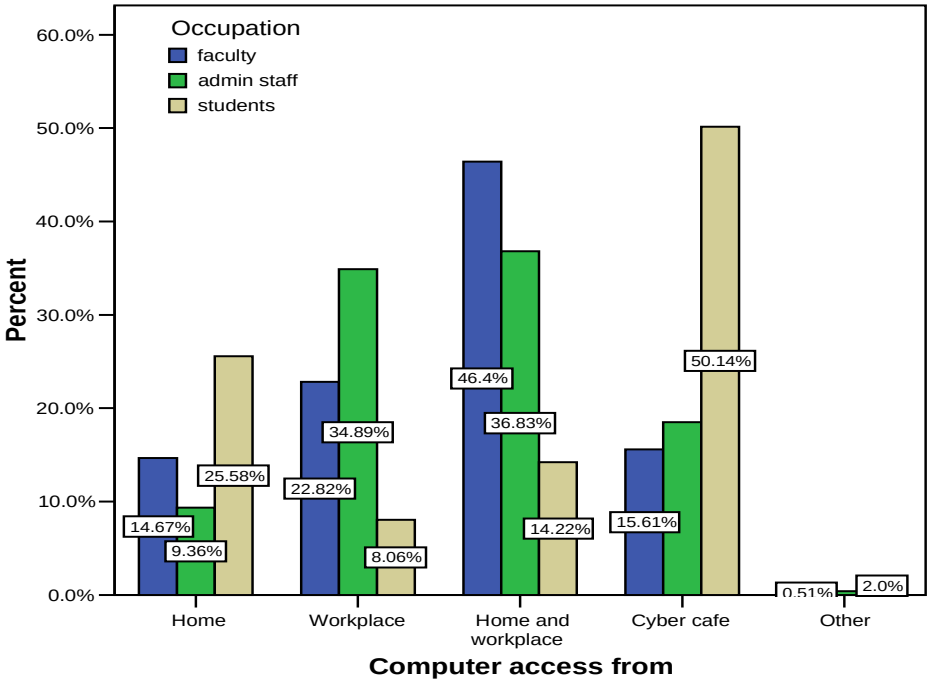
Although some universities had started providing wireless access to Internet to students by building hotspots, over 50% of the students still used cyber cafés for computer and Internet access as shown in Figure 4.2. This implied that the majority of students did not own PCs or laptops and universities have to continue investing in campus-based computer labs. In addition, laptops or individual PCs were not shared and had limited impact compared to computers in campus-based labs or cyber cafés.

Table 4.4 shows that small universities with an enrolment of 2,500 students or below had a PC ratio of 7.8 compared to 3.7 for large universities in the category of 5,000 – 20,000 students. The table also shows that small universities achieved the target of 1 Mb/s per 1000 students' ratio. Again, the large universities with student enrollment between 5000 and 20,000 students had only a bandwidth ratio of 201 kb/s per 1000 students. There were 12 large universities that had a combined enrollment of about 126,000 students. Large universities therefore would benefit significantly from accession to higher stages in Internet availability.

Table 4.4 Internet availability indicators for universities analyzed in terms of size of universities

Category	Number of Institutions	Total Number of students	Total Bandwidth (kb/s)	BW per 1000 students	PCs per 100 students
>20,000 students	5	142,450	58,700	412.1	6.1
5-20000 students	12	126,549	25,452	201.1	3.7
2.5 - 5000 students	16	70,500	41,724	591.8	5.0
Less than 2500 students	15	24,261	25,724	1060.3	7.8
Total	48	363,760	152,112	416.8	5.2

The low PC and bandwidth ratios in the universities drove students to cyber cafés as shown in Figure 4.3. Nearly 50% of the students accessed PCs and the Internet from cyber cafés. However, about 25% of the students reported that they had access to computers and Internet at home. The 2006 e-readiness survey in Kenya had indicated that only 20% of students had access to computers at home. Thus, an increasing proportion of students in Kenya now had PCs at home. In countries where campus networks were even more under-developed, for example in Burundi, about 87% of students reported that cyber cafés were their primary access to computers and Internet. In general, all universities in East Africa have to continue investing in campus-based computer labs.



source: KENET 2008

Figure 4.4: Location of primary access to computers by users in universities

4.1.3 Internet affordability

The universities achieved stage 1.5 in this indicator (see Figure 4.1). This means that institutions were spending about US$ 13,000 to 25,000 per 1000 students per year on Internet bandwidth [Kashorda and Waema, 2008]. The price of US$ 3,000 per Mb/s per month for satellite bandwidth in East Africa translated to about 360 kb/s to 700 kb/s per 1000 students. This was less than the 1 Mb/s per 1000 students' bandwidth target recommended in the 2006 e-readiness study.

If the total bandwidth were to drop to about US$ 500 per Mb/s per month with the availability of undersea optical fiber bandwidth, the same Internet budget will purchase above 1Mb/s per 1000 students. Although the prices of undersea fiber bandwidth could be as low as US$ 100 per Mb/s per month with purchase of Indefeasible Rights of Usage (IRUs) by universities, the high cost of distribution using leased lines in East Africa would mean that the total price would still be about US$ 500 per Mb/s. The lowest advertised price of bandwidth in Kenya in June 2009 was US$ 600 per Mb/s per month to buy less than 100 Mb/s [KDN, 2009].

4.1.4 Network speed and quality

The data for staging this indicator was obtained from the field survey of students, staff, and faculty. Six sub-indicators that measured quality and speed perceptions of the students and faculty were used to stage this indicator (see Chapter 2). At stage 2.2 in this indicator, most of students were dissatisfied with the quality of service as well as the speed. For example, about 55% of the students considered the campus networks unstable as shown in Figure 4.5. Moreover, Figure 4.6 shows that 86% of students preferred to use Web-based foreign e-mail

accounts (e.g., Yahoo, Google Mail, and Hotmail) compared to about 8% students who used institutional e-mail accounts.

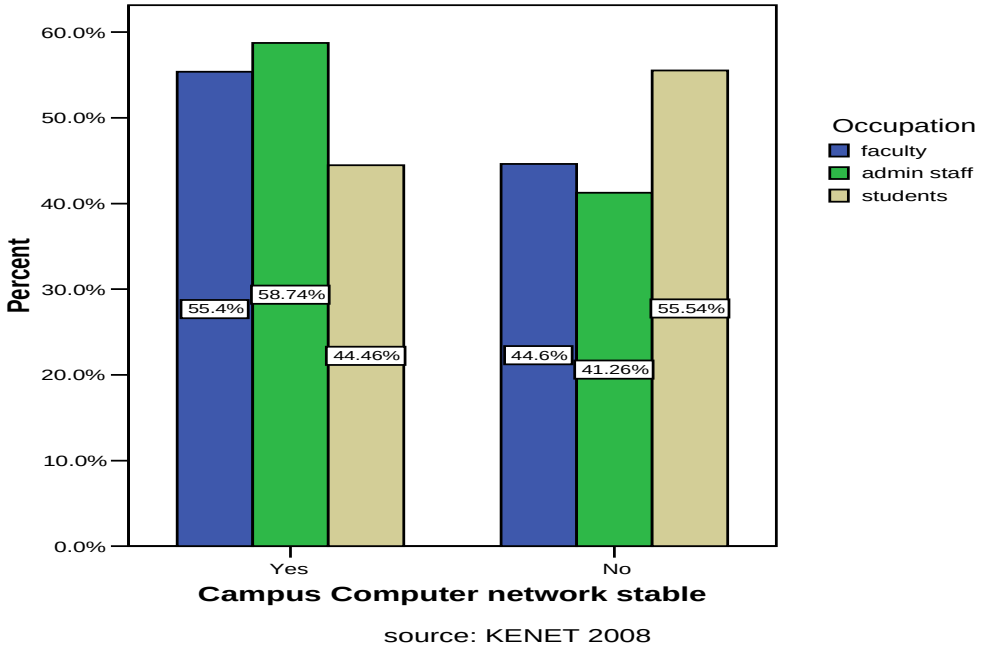


Figure 4.5: Stability of campus networks

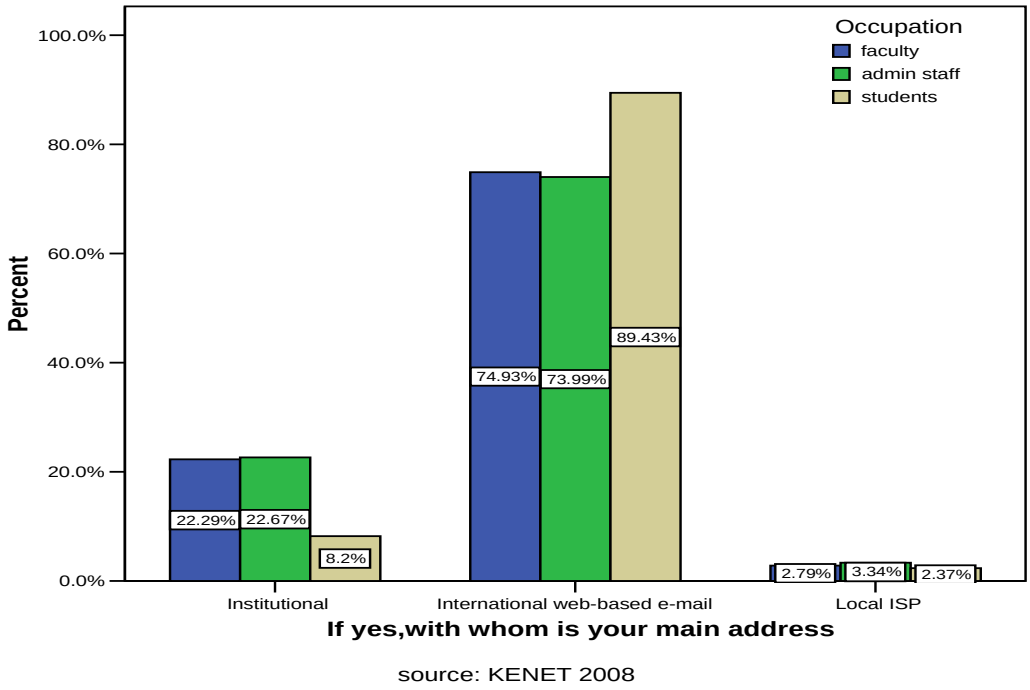


Figure 4.6: Provider of e-mail addresses

Another sub-indicator of network speed and quality indicator was the perceived speed of the campus Internet when compared to cyber cafés. Figure 4.7 shows that about 56% of the students considered cyber cafés better than campus networks in terms of Internet speed. In the 2006 study, 75% of the students reported that cyber cafés were faster while in the 2008 survey only 56% of student respondents considered cyber cafés better as shown in Figure 4.8. This

suggests that campus networks in Kenyan universities had improved significantly since the last study.

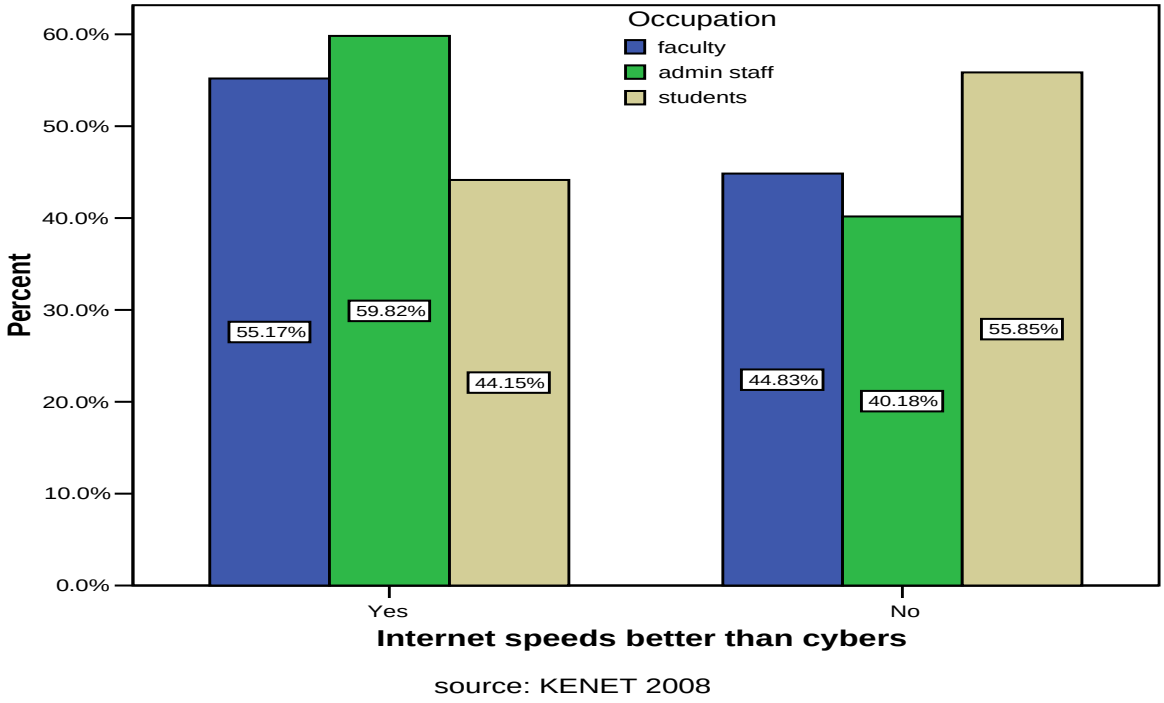


Figure 4.7: Perceived quality of campus networks and Internet by users (All universities)

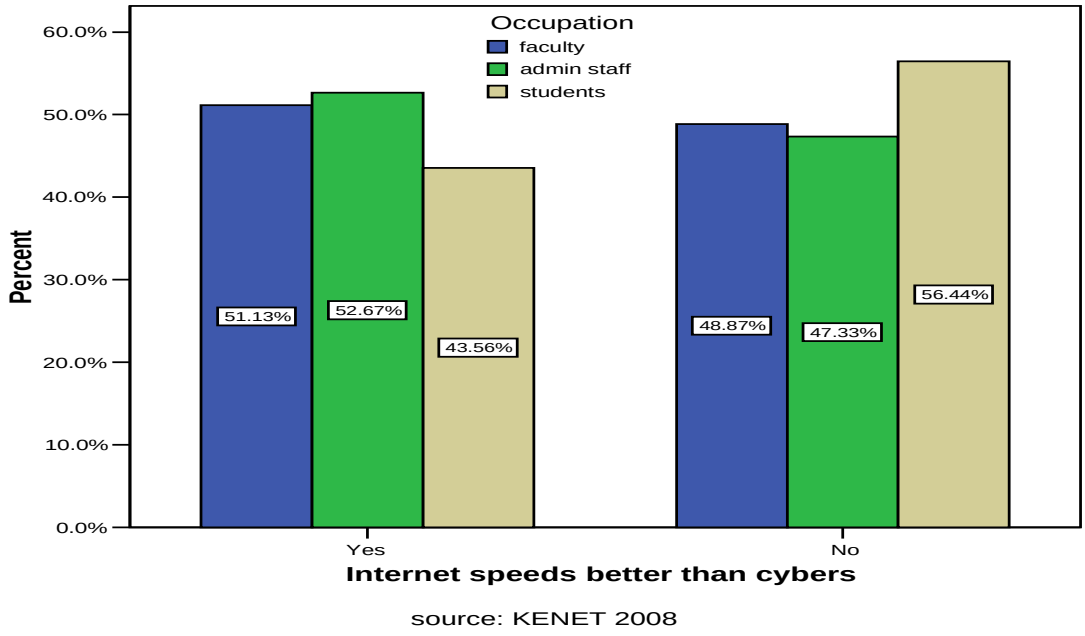


Figure 4.8: Perceived quality of campus networks and Internet by students in Kenyan universities

Figure 4.9 shows that about 69% of faculty and 72% of students reported that slow Internet on campus was slowing down their academic work. Although this was a negative perception of campus networks, it was better than the 2006 study results for Kenya that indicated that 83% for

faculty and 80% for students claiming that the campus Internet speed slowed down their academic work.

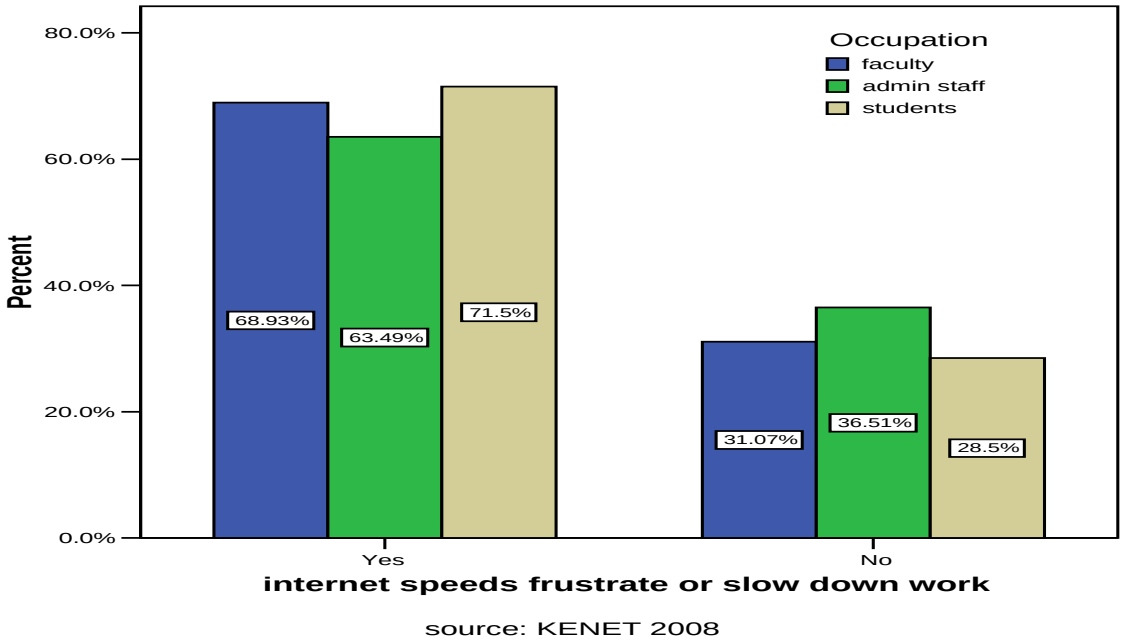
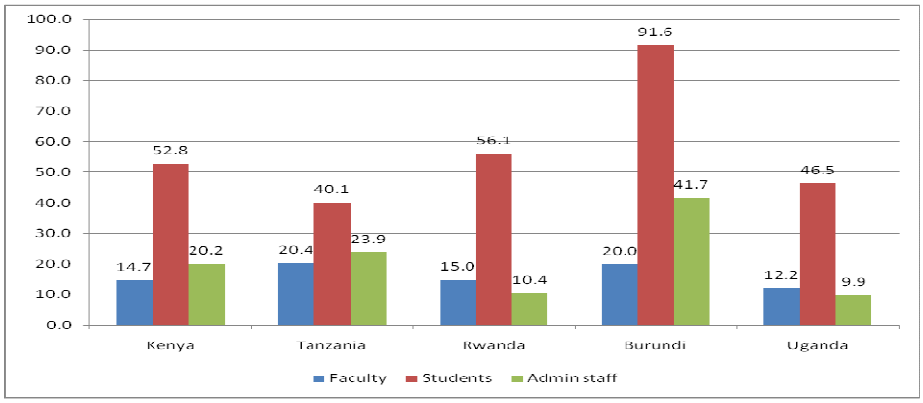


Figure 4.9: Effect of Internet speeds on academic work

Overall, over 50% of students in the universities accessed computers and the Internet off-campus at cyber cafés. Figure 4.10 illustrates the degree of dependence on cyber cafés by students in the different countries. In Burundi, about 90% of students used cyber cafés, while the lowest use of cyber cafés was in Tanzania at about 40%. This was not consistent with the relatively lower PC ratio of 2.2 (see Table 4.1) compared to Rwanda that had a 7.3 PC ratio and could mean that cyber cafés were not as pervasive in Tanzania as in other East African countries. Therefore, universities need to invest in campus networks and also increase Internet bandwidth in each campus. In addition, universities will need to conduct regular satisfaction surveys to ensure that investment levels in campus networks match population and perception of the users.



Source: KENET 2008

Figure 4.10: Percent of users with cyber café as primary computer and internet access location

4.2 Network Access average staging for individual universities

This section presents results of network access for universities in each of the five countries. The average stage for the indicators for each institution is useful for comparing the performance of different institutions in this category of indicators.

4.2.1 Kenyan universities

Figure 4.11 shows the average staging for Kenyan universities when compared with the e-readiness survey of 2006. Only three of the 17 universities surveyed achieved a readiness of stage 2.5 and above and only one university (United States International University, Nairobi, USIU) achieved stage 3 of readiness in 2006. In the 2008 survey, four universities achieved stage 2.5 and above and only one university (Strathmore University) achieved stage 3 of readiness. No public university achieved stage 2.0 and above. In fact, there was a decline for most universities in this category. This may be due to an increase in student enrollment without a corresponding increase in investment in PCs or Internet bandwidth.

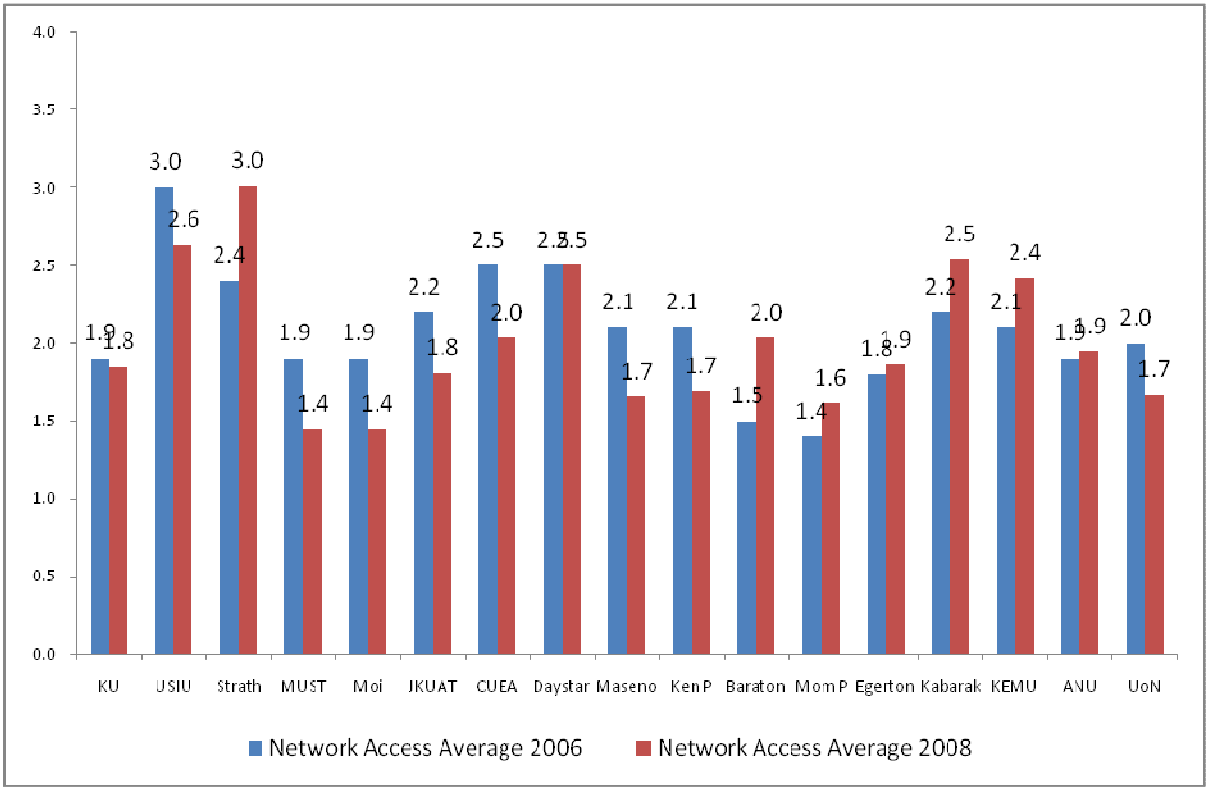


Figure 4.11: Network access average staging for Kenyan universities

4.2.2 Ugandan universities

Figure 4.12 shows the average network access staging for universities in Uganda. Only two universities, Makerere University and Makerere Business School were at stage 2 and above compared to seven of the 17 universities in Kenya. Thus, most of the universities in Uganda were not purchasing enough bandwidth (311 kb/s per 1000 students) although they had a relatively high PC ratio of 6.8 PCs per 100 students.

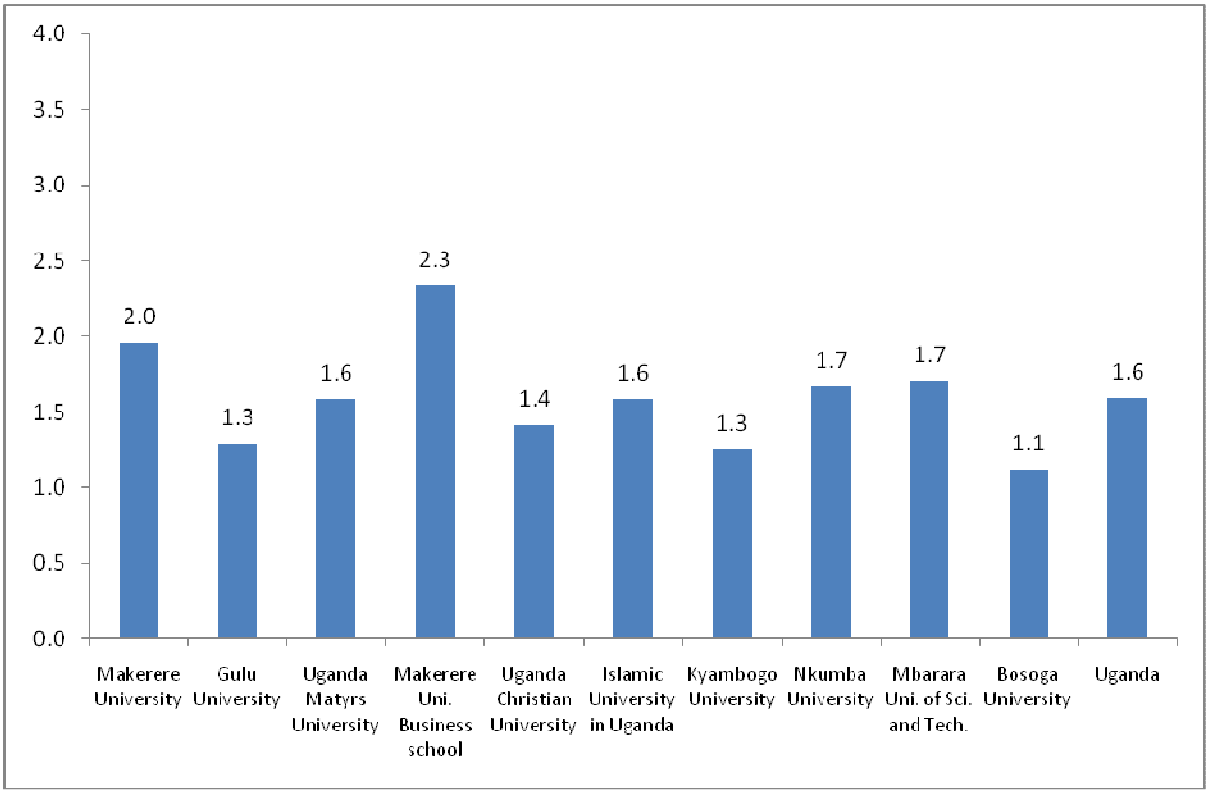


Figure 4.12: Network access for universities in Uganda

4.2.3 Tanzanian universities

The universities surveyed in Tanzania were at stage 1.8 on average as shown in Figure 4.13. This was not very different from the corresponding average of 1.6 for Ugandan universities and was consistent with the average of 1.7 for all universities in East Africa. However, three out of the 10 universities surveyed were at stage 2.0 and above. Only the University of Dodoma at stage 2.6 was in an acceptable state of readiness in this category. Tanzania's universities had a low PC ratio of only 2.7 PCs per 100 students compared, for example, to Uganda's 6.8 PCs per 100 students. Increasing PC ratio therefore should be prioritized in the universities' ICT budgets.

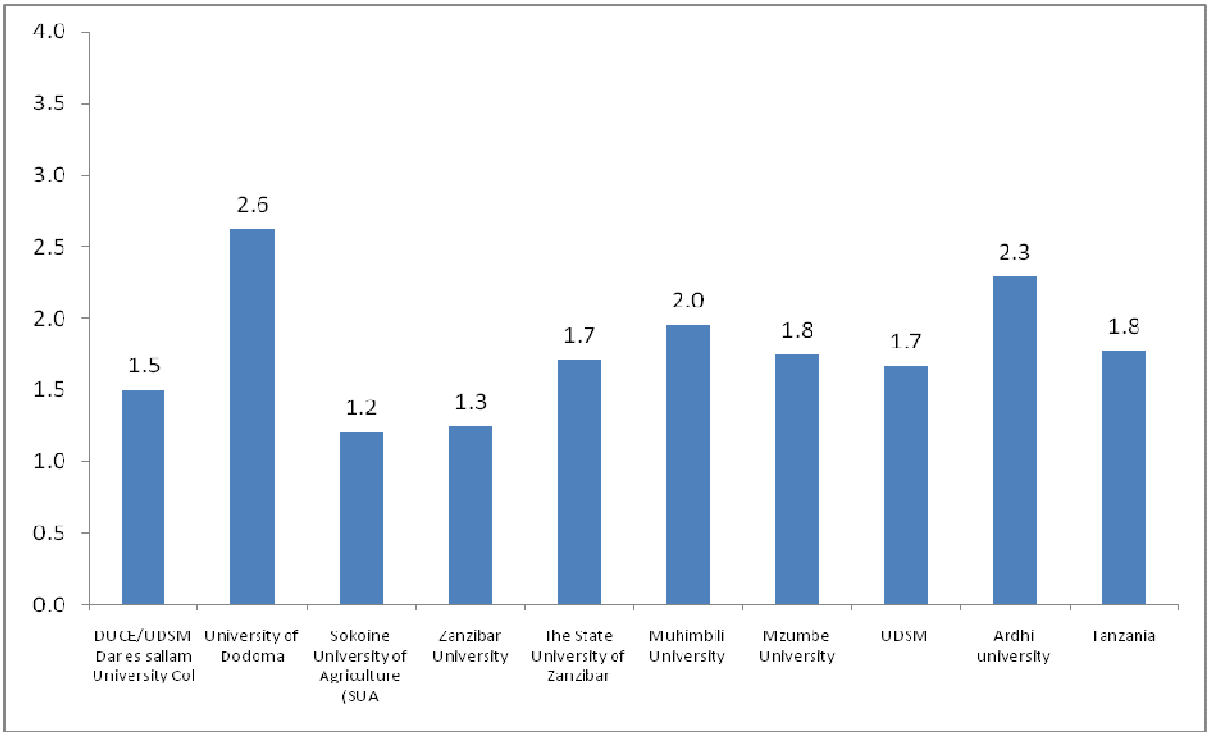


Figure 4.13: Network access stages for universities in Tanzania

4.2.4 Rwandan universities

Figure 4.14 shows the network access stages for universities surveyed in Rwanda. Only two of the eight universities surveyed were at stage 2.0 and above despite the universities having the highest PC and bandwidth ratios in the region as shown in Table 4.1. Although the network speed and quality in Rwanda was at stage 2.6, Rwandan universities were fully stretched in their Internet bandwidth expenditure. The priority for Rwanda is therefore to increase the Internet budgets or to increase the bandwidth subsidy further for universities (Table 4.2 shows that Rwanda had the lowest Internet bandwidth cost per Mb/s per month at only US$ 1,000 due to a Rwanda government bandwidth subsidy of US$ 2,500 per Mb/s per month for some universities.

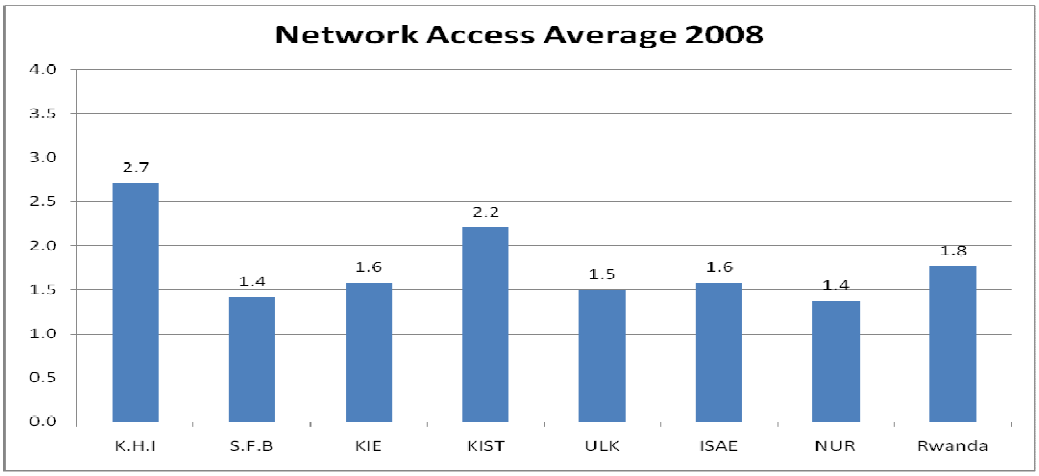


Figure 4.14: Network access stages for Rwanda universities

4.2.5. Burundi universities

Burundi universities lagged behind as none of the universities were at stage 2.0 and above, while two out of six universities surveyed were at stage 1 as shown in Figure 4.15. Table 4.1 shows that the six universities in Burundi were purchasing an average of 115 kb/s per 1000 students and providing only 1.5 PCs per 100 students. Burundi universities therefore have to dramatically increase their investments in ICT campus infrastructure and aim to reach stage 2.

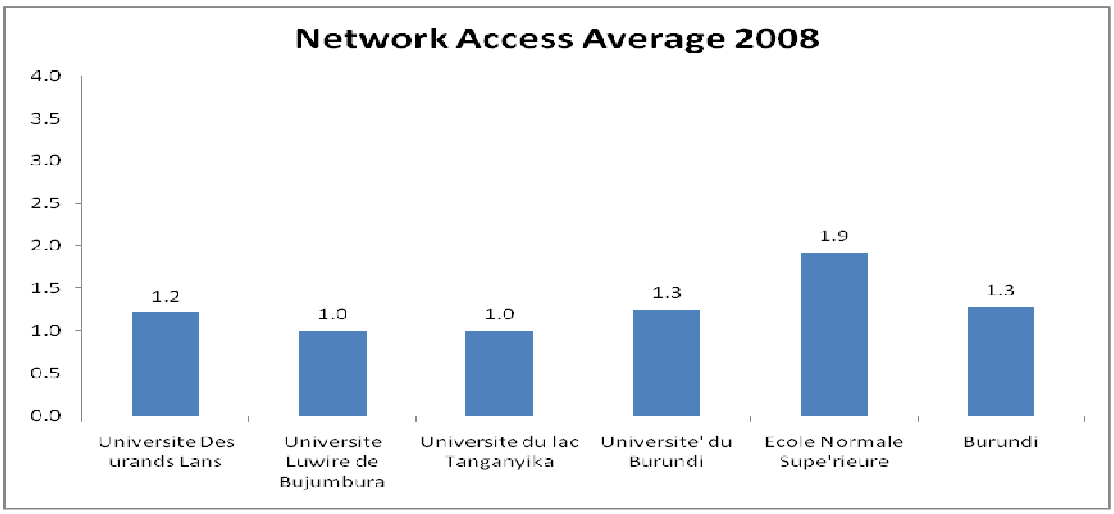


Figure 4.15: Network access stages for universities in Burundi

4.3 Network Access average staging by size

This study also analyzed the effect of student enrolment on the network access indicator for the 48 universities, categorized as: small (1000-2,500 students), medium (2,500- 5,000 students), large (5,000 – 15,000) and very large (over 20,000 students).

Figure 4.16 shows the results for the different categories. These results suggest that information infrastructure was independent of the size with the small universities being marginally at higher stage (1.8). The medium and small universities also were at marginally higher average stage (1.7) compared to the large or very large universities. Similarly even the network speed and quality perception does not appear to be significantly influenced by the size of the university.

This suggests that the strategy for accession will probably have a country context rather than size context for the network access category of indicators.

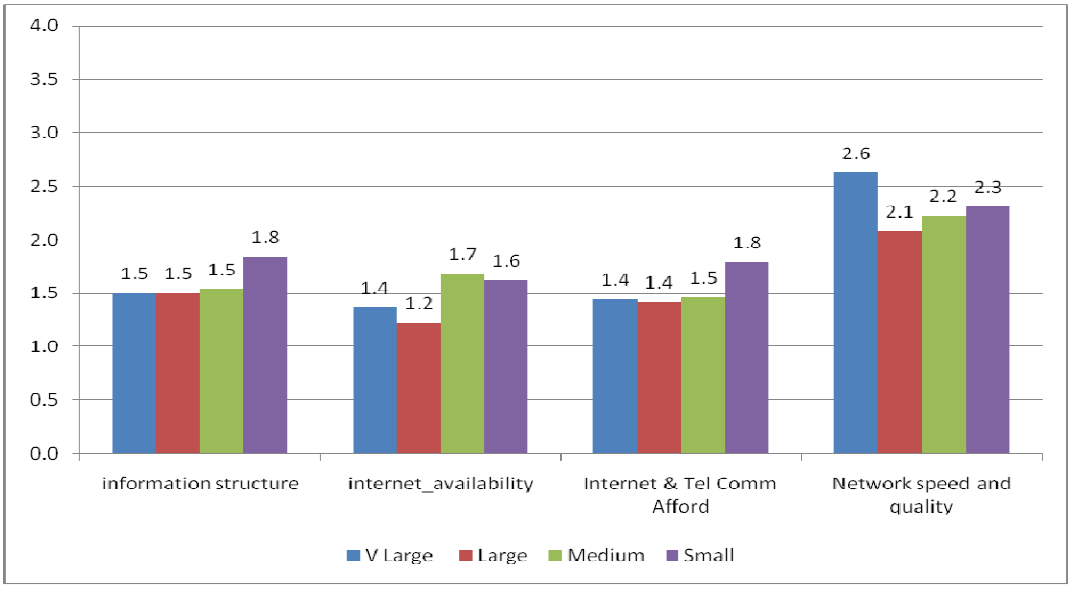


Figure 4.16: Network access staging by category of universities

5 NETWORKED CAMPUS

5.1 Overall staging for Networked Campus category of indicators

The networked campus category had two indicators: network environment and e-campus. The network environment category was measured using sub-indicators that included ICT power supply availability, security of ICT equipment and software, and availability of disaster recovery plans. The e-campus indicator measured the degree of automation of internal processes (i.e., existence of appropriate information systems) and electronic interactions of the campus with students, suppliers, and other stakeholders.

Figure 5.1 shows the overall staging of these indicators for the universities surveyed. The average for the universities was stage 2.5 except for Burundi which was below stage 2.0.

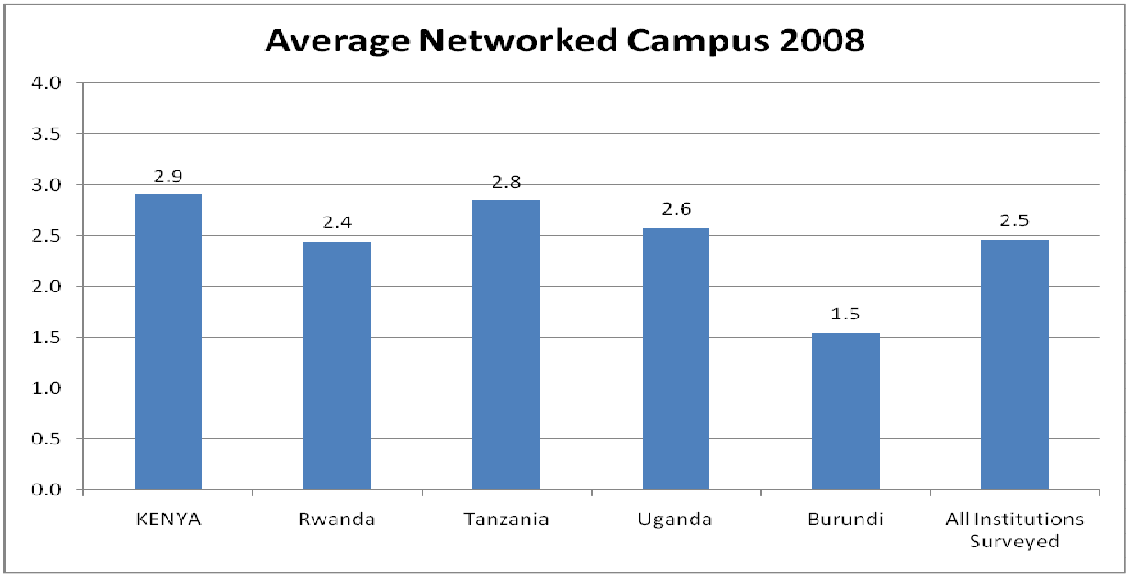


Figure 5.1: Overall staging of networked campus category showing all surveyed

Figure 5.2 shows the staging for networked campus category. All universities were at higher stages in the networked environment indicator compared to the e-campus indicator, suggesting low levels of automation of processes and systems. Burundi at stage 1.2 in e-campus was yet to start automating its internal processes. Kenya and Tanzania were at stage 2.6 in e-campus indicator and had achieved relatively high levels of automation particularly of their financial systems. For example, the data indicated that 100% of the Rwandan universities, 94% of Kenyan universities, 89% of Ugandan universities, 83% of Tanzanian universities and 20% of Burundi universities had automated their financial systems.

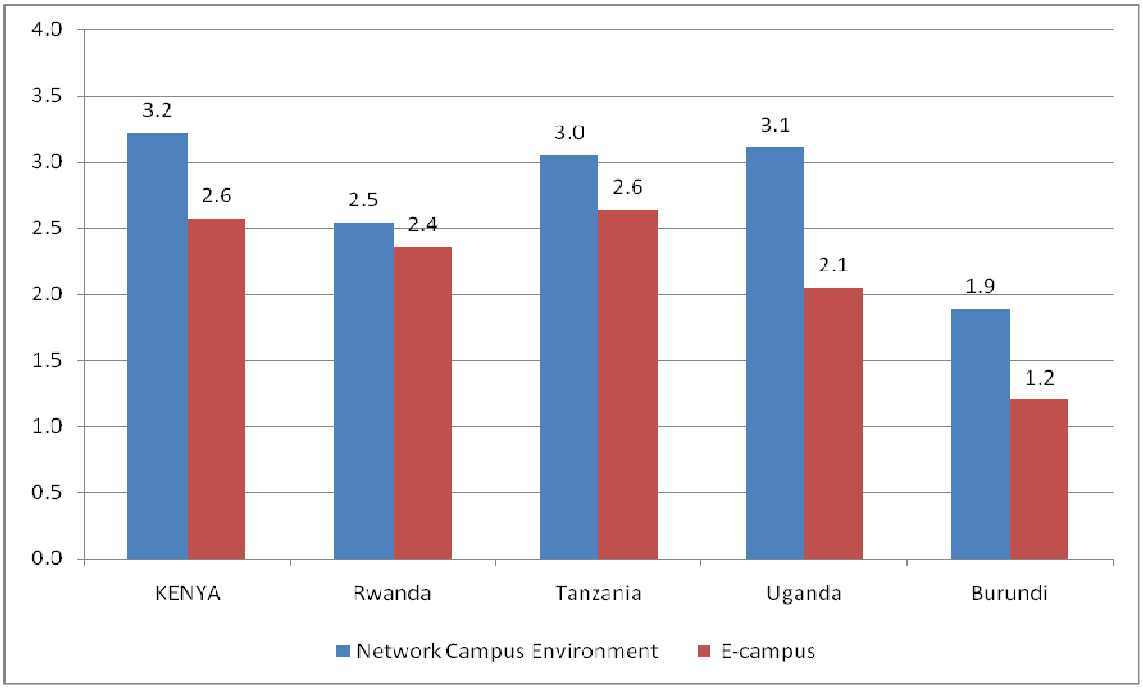


Figure 5.2: Average staging for networked campus indicators

5.1.1 Networked environment

At stage 2.8, most of universities were ready for extensive use of ICT to support teaching, learning, research, and management. For example, about 65% of all institutions had uninterruptible power supply (UPS) for PCs in the offices while 58% of the PCs in the student labs had a UPS. In 2006, only 46% of PCs in the student labs had a UPS in Kenyan universities. Therefore universities need to invest in the network environment to achieve the 75% of UPS in student labs required for stage 4.

With respect to security of ICT facilities in campuses, about 70% of the universities had a firewall to protect their Intranets. This was lower than the 85% of institutions surveyed in 2006. About 94% of Kenyan universities had a firewall compared to 56% in Rwanda . In Burundi, only 17% had a firewall. This means that many universities in East Africa lacked protection against external threats and did not take the threats seriously. Moreover, only about 37% had an off-site back-up and 26% had a disaster recovery plan. This means that most universities have not prioritized disaster management. This is a critical issue that needs urgent attention and should be included in institutional ICT strategic plans.

5.1.2 E-campus indicator

This indicator was measured using a variety of sub-indicators such as frequency of updates of websites, extent of online interactions with suppliers, degree of automation of campus processes, and integration of information systems. All universities were below stage 3 in this indicator. This means that websites were not updated frequently (e.g., weekly) and there was limited online and e-mail interaction with suppliers, students, employees, and other stakeholders. For example, only 30% of universities updated their websites weekly. However about three quarters (76%) updated

their web information at least once a month. This was an indication that the information in most of these websites was about a month old.

Most universities could not provide information on the extent of electronic interaction with suppliers or the value of online business transactions. However, 34% indicated some level of online interactions with external entities. The highest level of electronic transaction was in Tanzania where 70% of the universities reported some level of electronic transactions followed by Uganda, with about 37% reporting some level of interactions with suppliers. In Kenya, only 13% had some interactions with suppliers, while in Burundi, no university recorded any electronic transactions.

5.2 Networked Campus average staging for individual universities

This section presents examples of the staging of individual universities in the five East African universities.

5.2.1 Networked campus staging for Kenyan universities

Figure 5.3 shows the comparison average staging of the 17 Kenyan universities surveyed in 2006 and in 2008. About 50% of the universities were at a higher stage in average networked campus in 2008 as compared to 2006. However, an equal number of universities recorded marginal decrease in the average stage of this indicator. This was a surprising result and could mean that university enrollment had increased without corresponding increase in the campus ICT infrastructure. Only six out of the 17 Kenyan universities were at stage 3 and above.

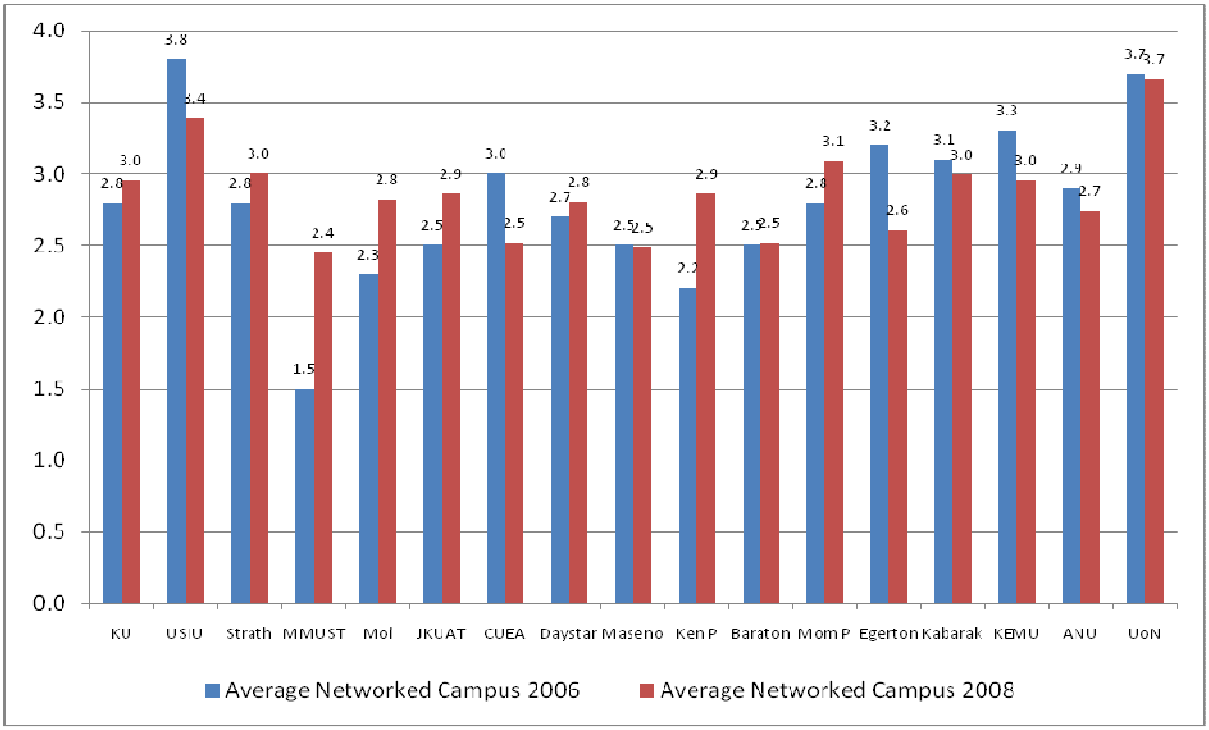


Figure 5.3: Networked campus stages for Kenyan universities

5.2.2 Networked campus staging for Ugandan universities

Figure 5.4 shows the stages for Ugandan universities surveyed. Makerere University was unique at stage 3.9, with Uganda Matyr's University, placed at stage 3.0. Three universities (Gulu, Uganda Christian, and Busoga) out of 11 universities were at stage 2 and below. This suggests that most of the Ugandan universities surveyed will need to focus on the networked environment category of indicators and sub-indicators in their strategic plans in the next two years.

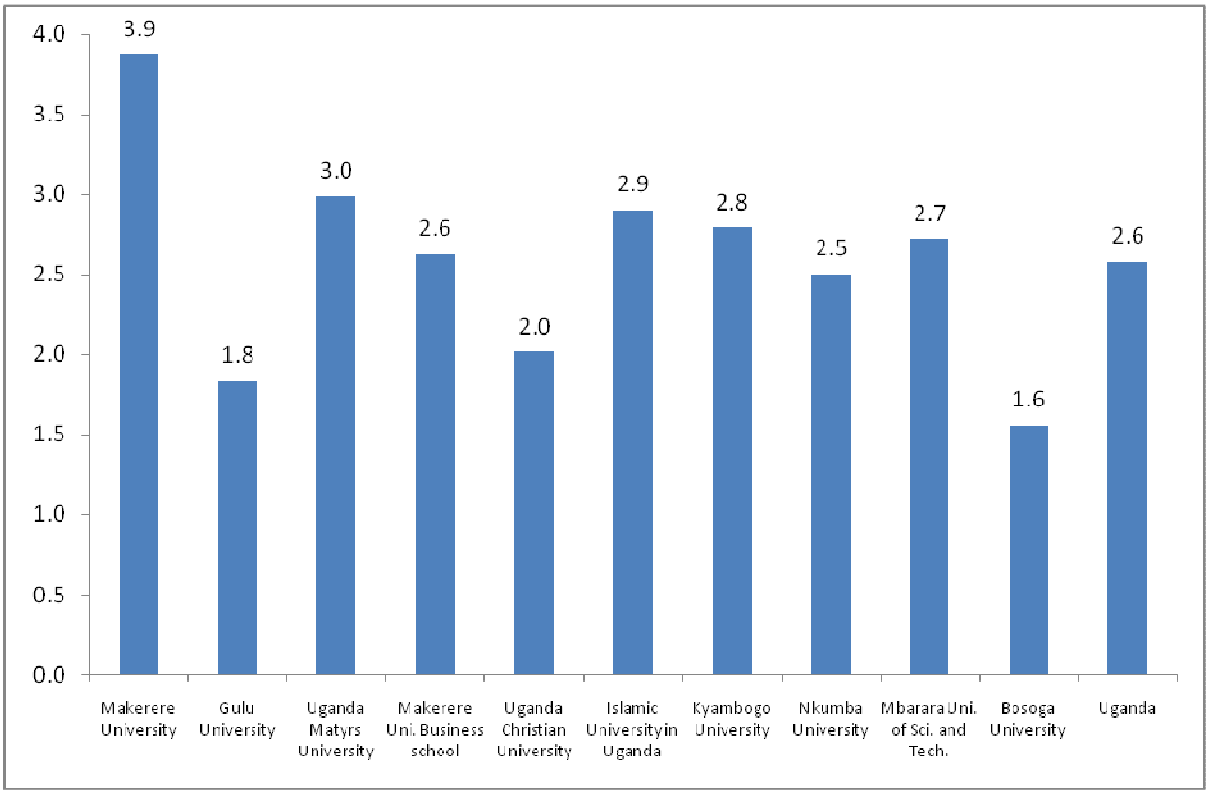


Figure 5.4: Networked campus staging for Ugandan universities

5.2.3 Networked campus staging for Tanzanian universities

The stages for Tanzanian universities are shown in Figure 5.5. Four out of the 10 universities surveyed were at stage 3 and above, while all were at stage 2 and above. This means that most of the universities surveyed in Tanzania were ready to deploy ICT in teaching, learning, and research on a large scale.

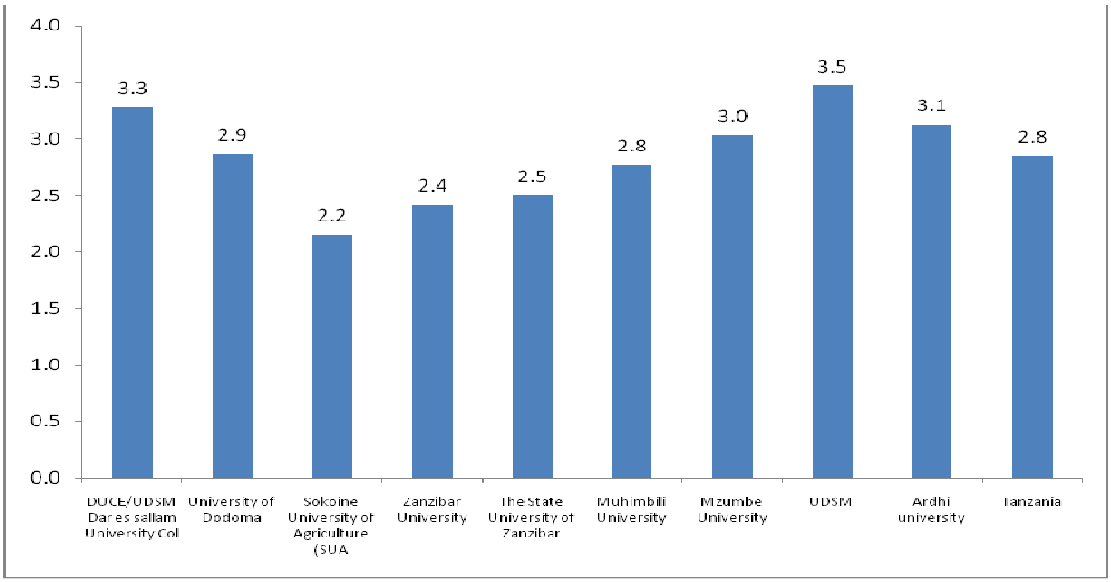


Figure 5.5: Networked campus staging of universities in Tanzania

5.2.4 Networked campus staging for Rwandan universities

In Rwanda, two universities, KHI and NLK, out of the eight surveyed were at stage 3 and above as shown in Figure 5.6. One of them, (ISAE) was at stage 1.3 suggesting that the campus was not ready to use ICT. The surprise result was KIST, the leading university of technology in Rwanda, which was placed at stage 2.2. Overall, universities in Rwanda will need to invest more in the network environment to increase the level of automation of their business processes.

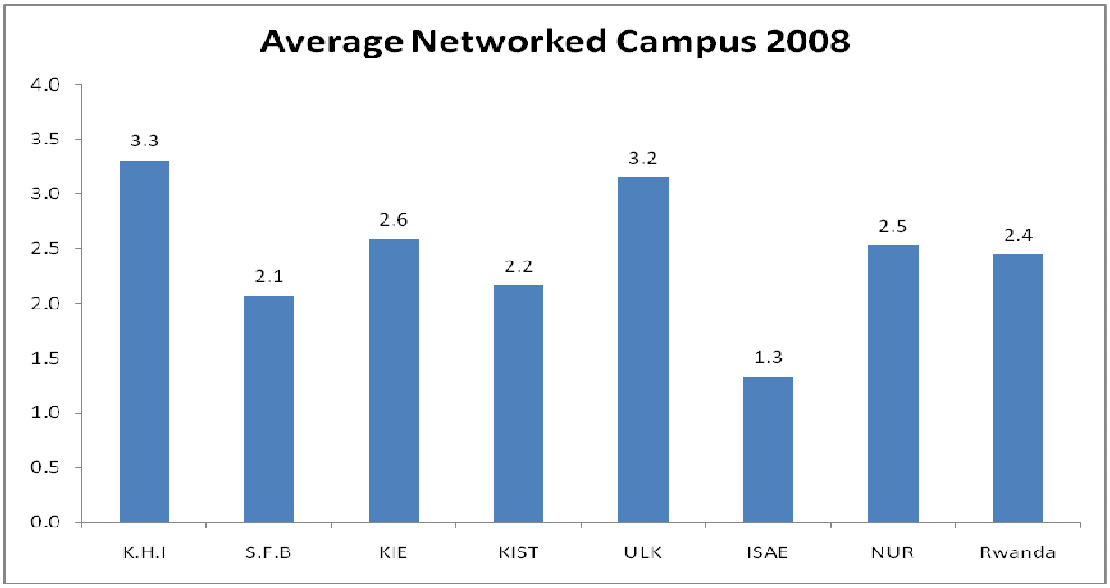


Figure 5.6: Networked campus staging universities surveyed in Rwanda

5.2.5 Networked campus staging for Burundi universities

On average, universities in Burundi were in much lower state of readiness in this category as shown in Figure 5.7. For example, the University of Tanganyika was the only university at stage

2. One university, University des Erans Lans, was at stage 1.1, suggesting that it was not using ICT in any significant way. The development of the network campus environment should therefore be accorded high priority if the universities are to benefit from ICT applications in teaching, learning, and research. Universities in Burundi have to include development of the campus environment in its institutional strategic plans.

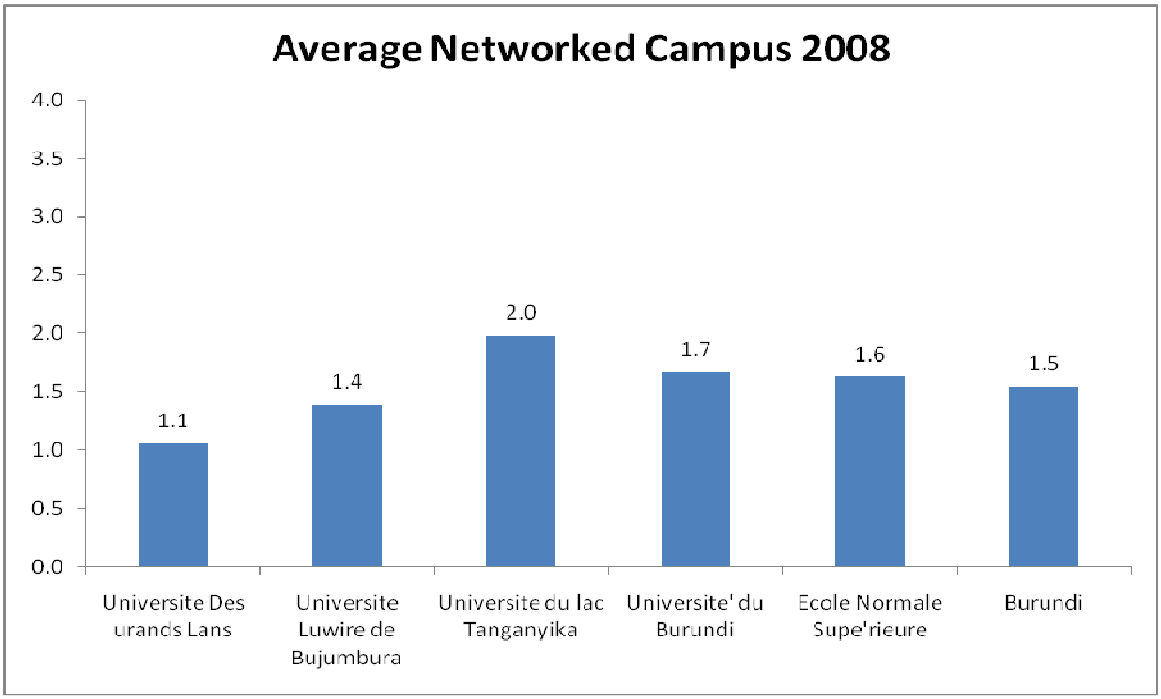


Figure 5.7: Networked campus staging for universities surveyed in Burundi

5.3 Networked Campus average staging by size

Analysis of the staging networked campus was also done by size as defined in Chapter 2. On average, it appears that very large universities are at stage 3.4 and above in both the network environment and e-campus indicators as shown in Figure 5.8. All categories of universities were at stage 2.5 and above for the network environment category. However, only the very large universities were at stage 2.5 and above in the e-campus indicator (at stage 3.4). This suggests that the degree of automation of internal processes and use of ICT to interact with internal and external stakeholders was only prevalent in very large universities.

Thus, size seems to be a significant determinant in the degree of readiness in this category of indicators. This will require further analysis in the second phase of the accession project. It is expected that small and medium universities would be more intense users of ICT in their internal and external processes but this has not been the case.

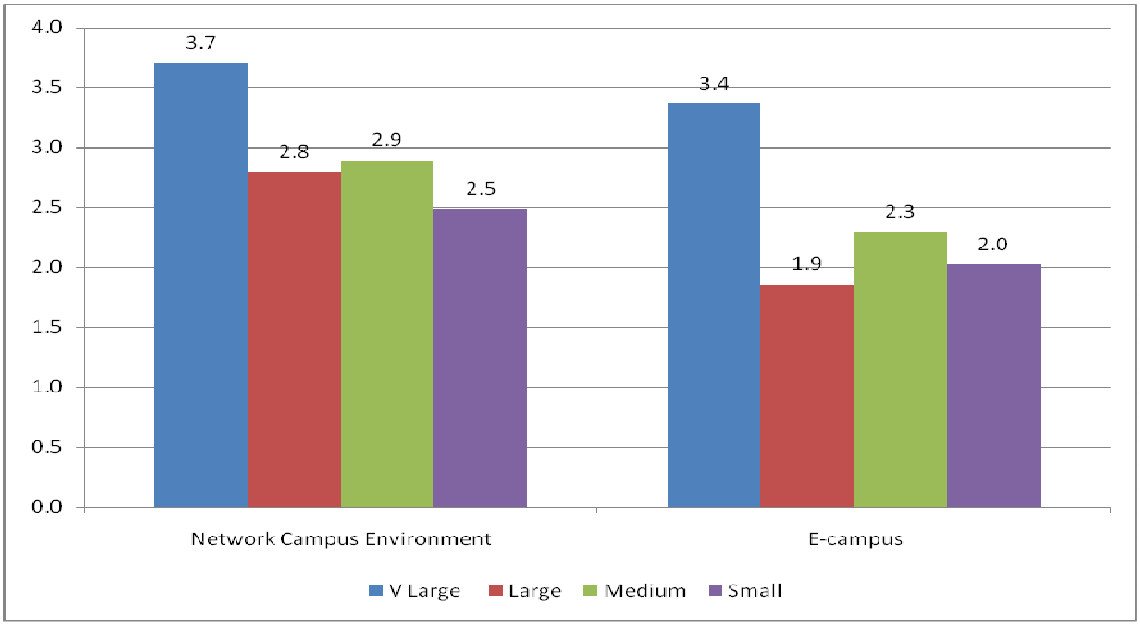


Figure 5.8: Networked campus staging of indicators by size category of universities in East Africa

6. NETWORKED LEARNING

6.1 Overall staging for Networked Learning category of indicators

The networked learning category contained the following indicators:

(i) Enhancing education with ICT
(ii) Developing ICT workforce
(iii) ICTs in libraries
(iv) ICT research and innovation

Initially a fifth indicator on enhancing research with ICTs was included, but the data collected was insufficient for staging. This indicator was therefore not analyzed although some of the ways that faculty use ICT for their work was captured and analyzed.

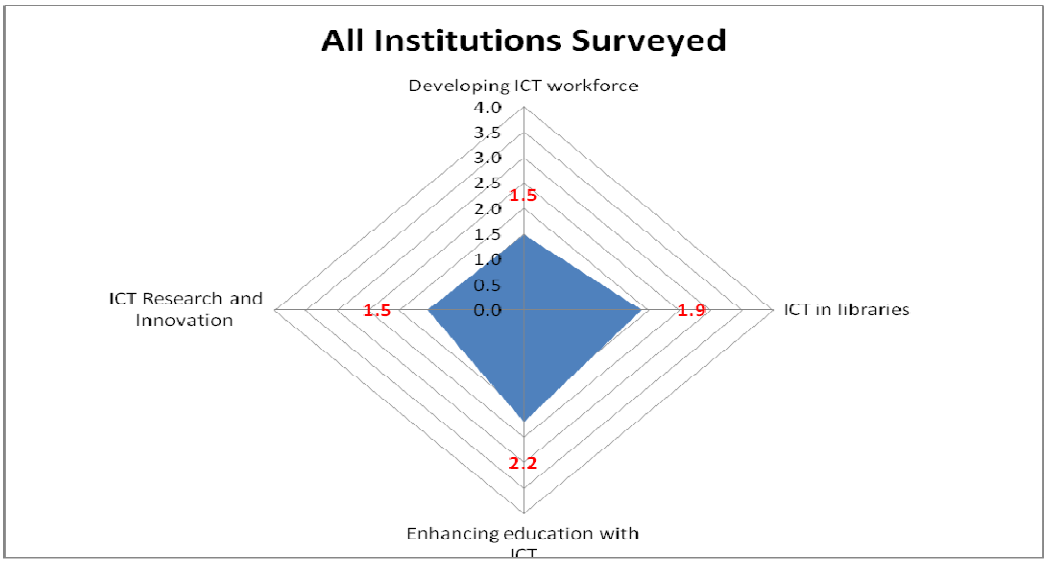


Figure 6.1: Overall staging for networked learning category of indicators

Figure 6.1 on the staging of the four indicators for all universities surveyed shows they were below stage 2.0 in all indicators except enhancing education with ICT, which is placed at stage 2.2.

6.1.1 Enhancing education with ICT

The sub-indicators for enhancing education with ICT include integration of ICT into the curricula, availability and use of e-learning platforms, and use of ICT in student projects. The fact that universities were at stage 2.2 meant that institutions were at the initial stages of using ICT in learning and teaching. For example, only 28% of the universities reported that they were using e-learning in some of their courses. Furthermore, data on the percentage of courses that were being supplemented by e-learning materials was not available. That is, most of the universities did not track progress in developing e-learning materials by faculty.

Figure 6.2 shows the staging of the networked learning indicators for each country. Kenyan universities were at a relatively higher stages of the enhancing education with ICT (2.7) compared to the overall average of 2.2 for all universities in East Africa. Burundi had a low score of 1.8.

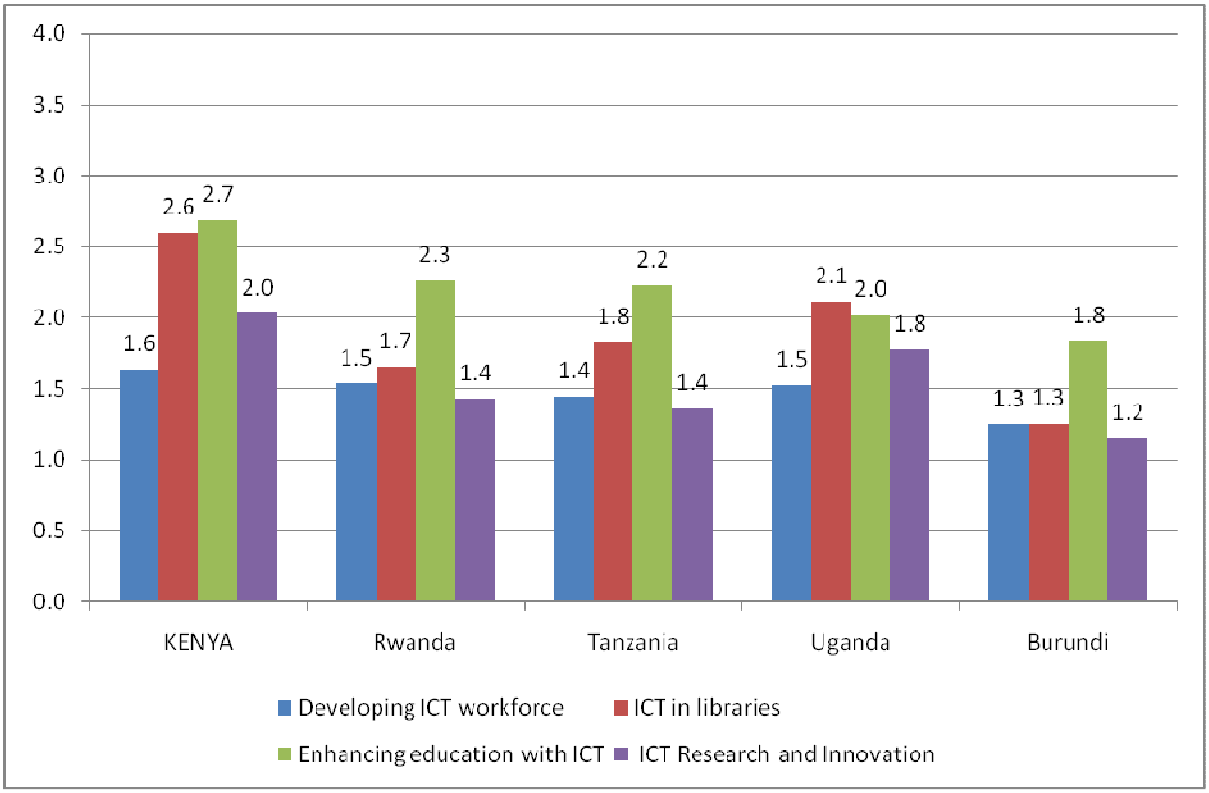


Figure 6.2: Staging of networked learning category of indicators by country

6.1.2 ICT in libraries

On average there was low usage of ICT in libraries. For example, only 27% of universities had Online Public Access Catalog (OPAC) available off-campus, indicating that most university libraries were not yet ready to provide digital library services. Only Kenyan universities achieved stage 2.6 in this indicator followed by Uganda at stage 2.0. Thus, only a few universities like USIU in Kenya and Makerere University in Uganda were fully automated and were supporting users with ICT and performing all their back-end operations, including procurement, using ICT.

6.1.3 ICT in research and innovations

ICT research and innovation indicator was also low at stage 1.5. This indicator was measured indirectly using the sub-indicators of ICT degrees (undergraduate, Master's, and PhD) and participation of students in national and international ICT exhibitions and competitions. A low score suggests few institutions were offering Master's and doctoral degrees in ICT or participating in the exhibitions. For example, only 30% of the universities were offering Master's degrees in ICT and 11% doctoral degree programs in ICT. Furthermore, only 43% of the

universities participated in national or international exhibitions. This was despite the fact that 72% of the universities surveyed were offering undergraduate degree programs in ICT.

The results also show that only about 17% of the lecturers had setup or were using research databases as shown in Figure 6.3, implying that use of ICT and Internet for research was not common practice.

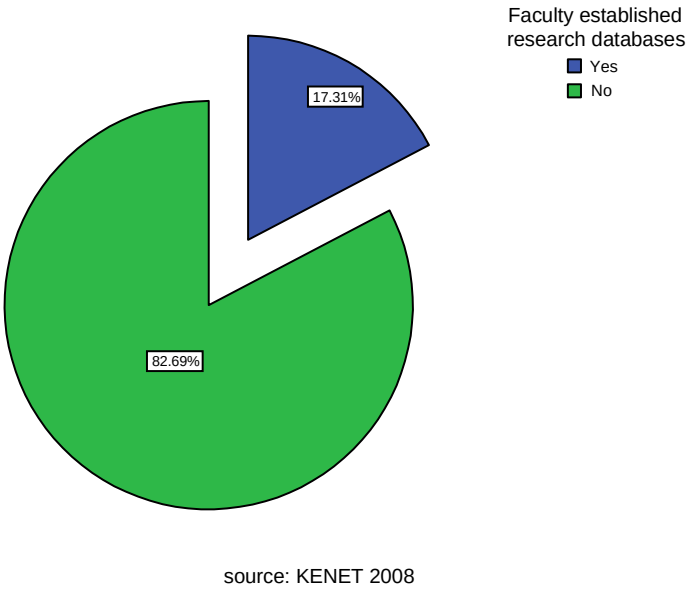


Figure 6.3: Lecturers using or setting up research databases

In general, all universities performed poorly in ICT research and innovation as shown in Figure 6.2. For example, only Kenyan universities achieved stage 2.0 while Tanzania, Rwanda, and Burundi were all below stage 1.5. This indicator is critical for the adoption of ICT in universities in East Africa and should be considered strategic by all universities.

6.2 Networked Learning average staging for individual universities

Figure 6.4 shows that Kenyan universities were at stage 2.2 while the other universities were below stage 2. However, in general, the universities did not perform well in this indicator with an average of only 1.8. These stages in each country are analyzed in the following section:

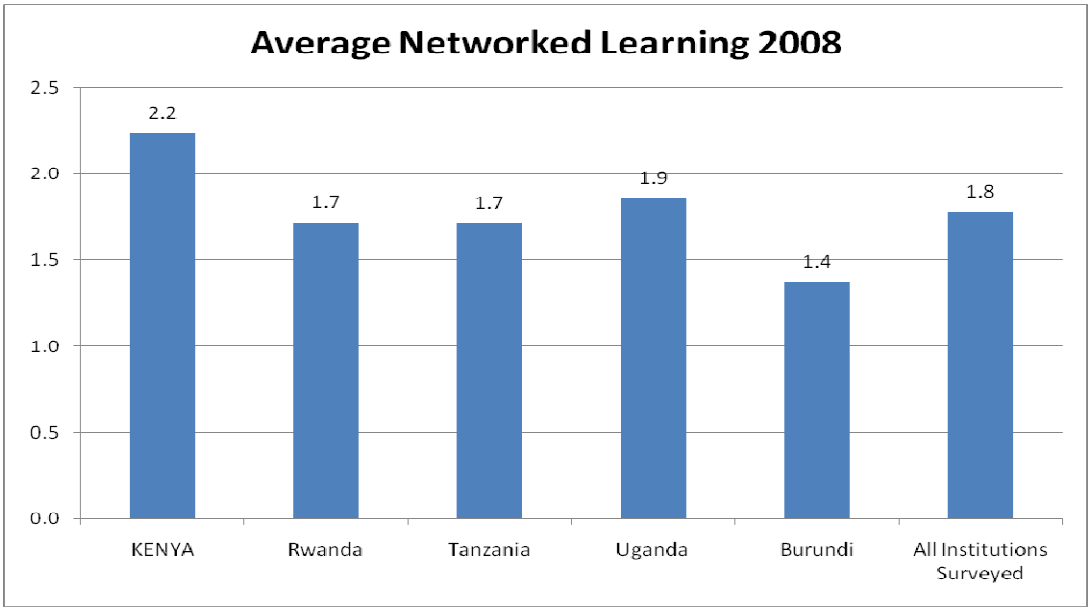


Figure 6.4 : Comparison of the average networked learning stages for universities in East Africa

6.2.1 Networked Learning Indicator stages for Kenyan Universities

Figure 6.5 shows the overall stages in the four networked learning indicators for Kenyan universities. Kenyan universities were at stage 2.6 for ICT in libraries indicator and stage 2.7 in enhancing education with ICTs compared to stages 2.0 and 2.1 respectively in the 2006 survey. It is only in the developing ICT workforce where there was no improvement.

Figure 6.6 compares the results from the 2006 and 2008 surveys for the 17 Kenyan universities. In the 2006 survey, only one public university was at stage 2.5 and above in the average networked learning while four out of the seven public universities were at stage 2.5 and above in the 2008 study, namely, Kenyatta University, JKUAT, University of Nairobi, and Moi University. Thus, the public universities had improved in networked learning indicators while some private universities recorded a drop in this category of indicators. Consequently, only two of the 10 private universities were at stage 2.5 and above, namely USIU and Strathmore University.

In summary, 10 out of the 17 universities surveyed in Kenya recorded an improvement in average networked learning staging while four recorded a drop. Three of the four universities that recorded a drop were private universities and this is an area that requires further study especially considering that private universities in Kenya were at higher stages in network access and networked campus indicators.

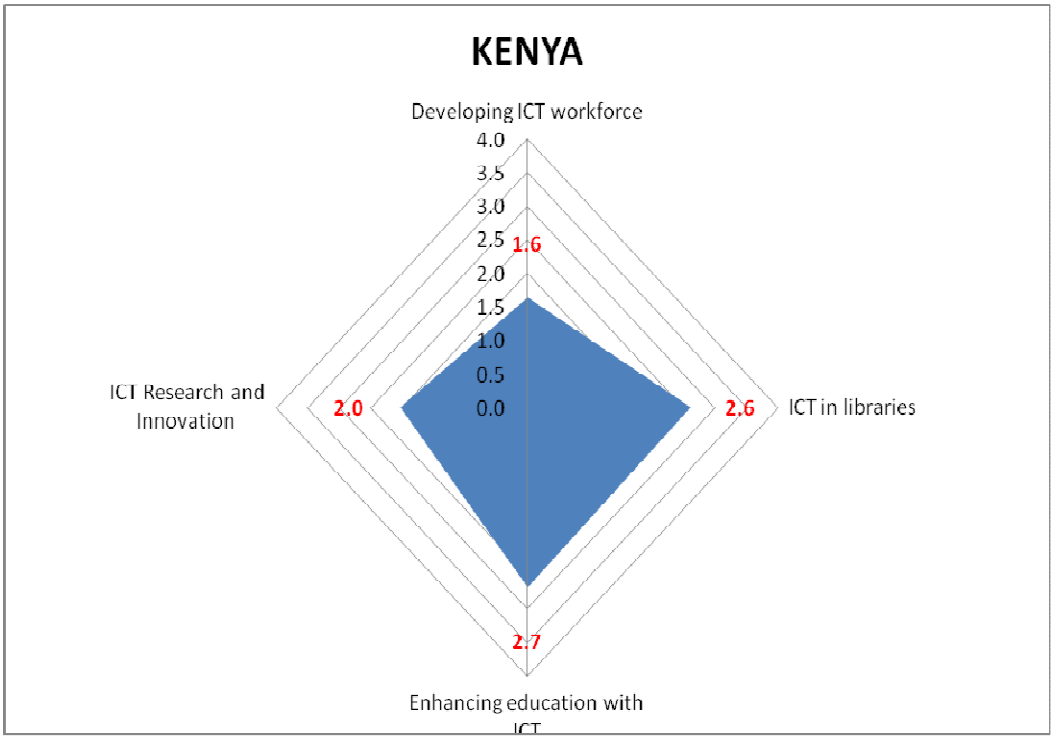


Figure 6.5: Overall networked learning indicator stages of Kenyan universities

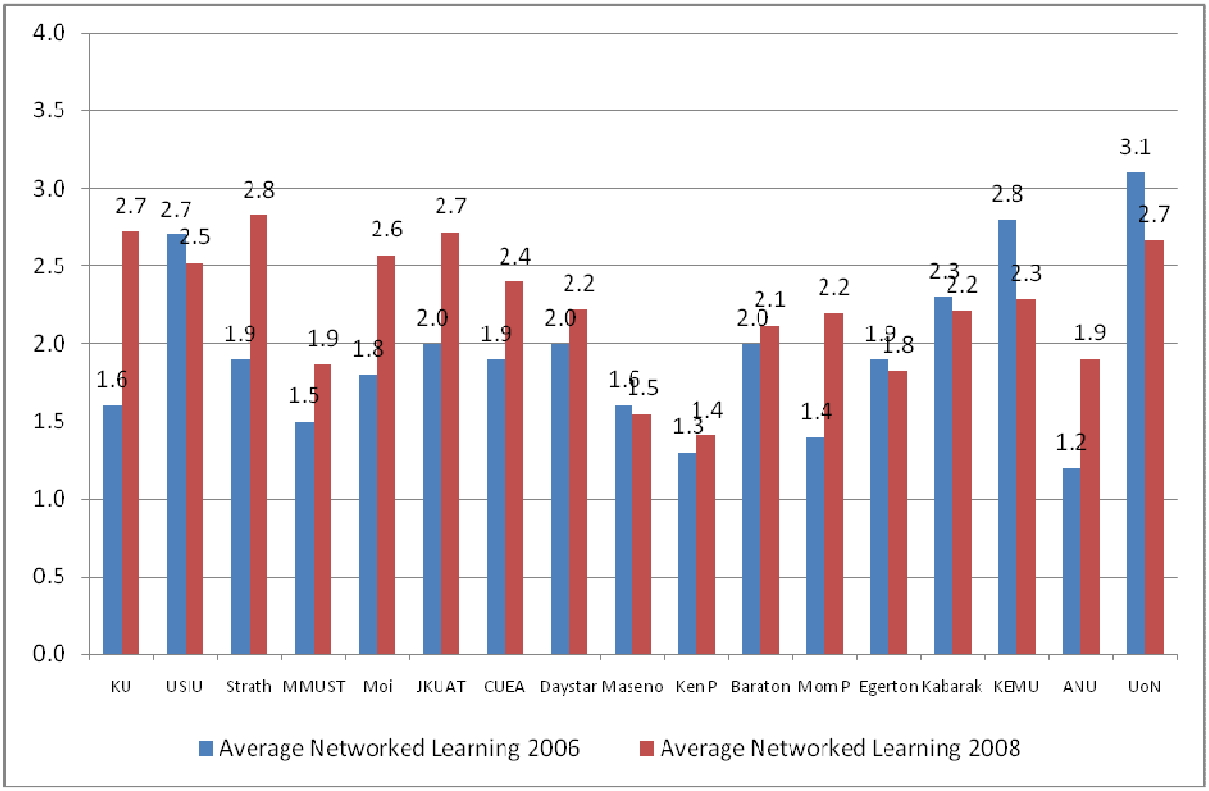


Figure 6.6 Networked learning stages for individual Kenyan universities

6.2.2 Networked learning indicator stages of Tanzanian Universities

Figure 6.7 shows that on average, the universities surveyed achieved stage 2.0 in enhancing education with ICT indicator. They were placed at stage 1.4 in both developing ICT workforce and ICT research and innovation indicators. This suggests that ICT is not aligned to learning in most universities in Tanzania. For example, Figure 6.8 shows that only two universities of the 10 surveyed were at stage 2.0 and above. Moreover, only the University of Dar es Salaam was at stage 2.5 and above compared to eight of the 17 universities in Kenya. This was a surprising result because universities in Tanzania were well equipped in ICT when measured using the network access and the networked campus indicators.

A more detailed analysis will be required to establish the reasons why ICT is not prioritized by universities in Tanzania yet it is the only country with an open university using ICT for learning.

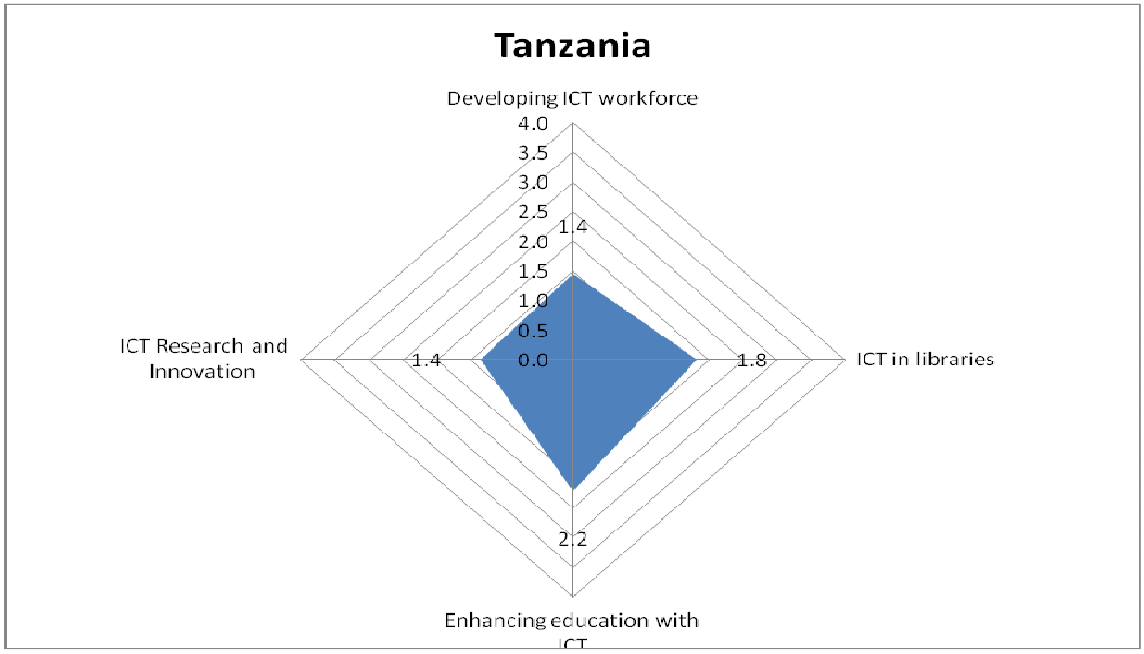


Figure 6.7: Networked learning indicator stages for universities surveyed in Tanzania.

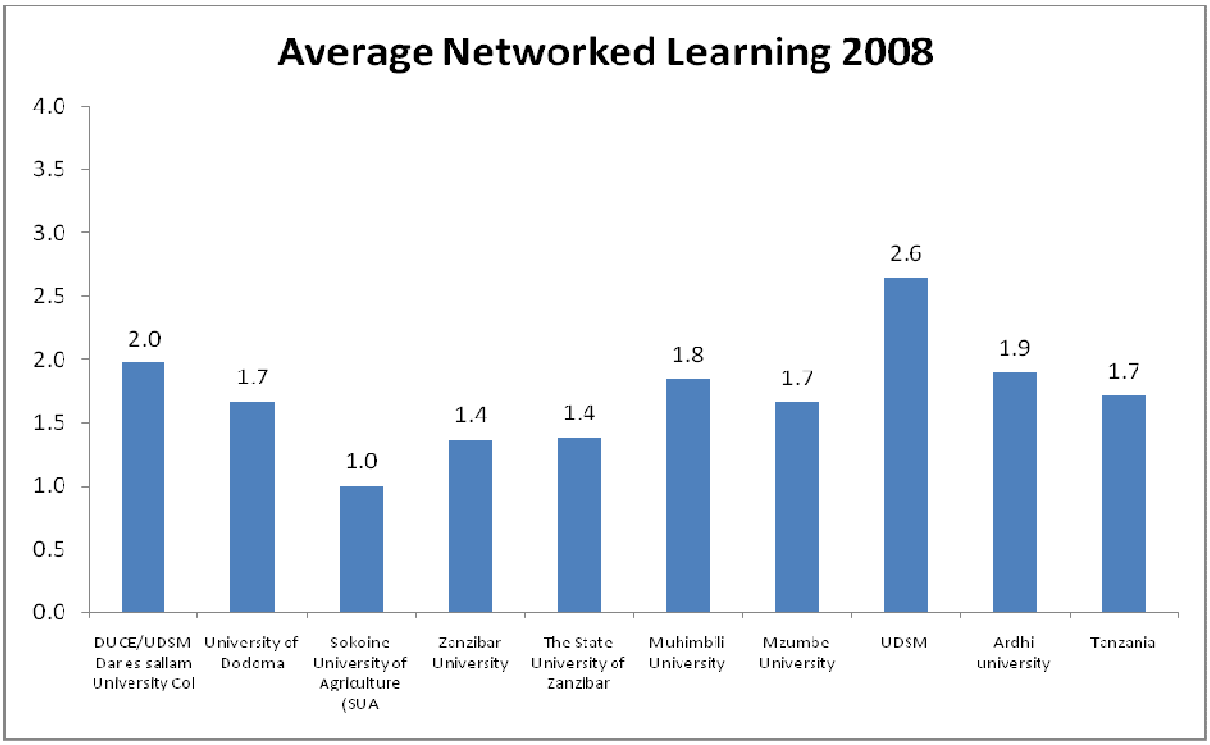


Figure 6.8: Networked learning indicator averages for universities in Tanzania

6.2.3 Networked learning staging of Ugandan universities

Universities in Uganda were at stage 2.0 and above in two networked learning indicators: enhancing education with ICT and ICT in libraries as shown in Figure 6.9. The universities were only at stage 1.5 in the developing ICT workforce indicator. This was surprising considering the focus of Uganda on ICT as described in the ICT context in Chapter 1 of this report.

Results of the average networked learning stages of individual universities are shown in Figure 6.10. The results show that only two universities, Makerere University and Uganda Matry's University were at stage 2.0 and above, in this category of indicators. Makerere University at stage 2.8 was above the other 11 universities surveyed which were placed below stage 2.0. This suggests that Ugandan universities in general were yet to align ICT with learning and had weak ICT policies and strategies. It was not clear why Makerere University performed better than the other universities surveyed and further study is required in Phase 2 of this accession project.

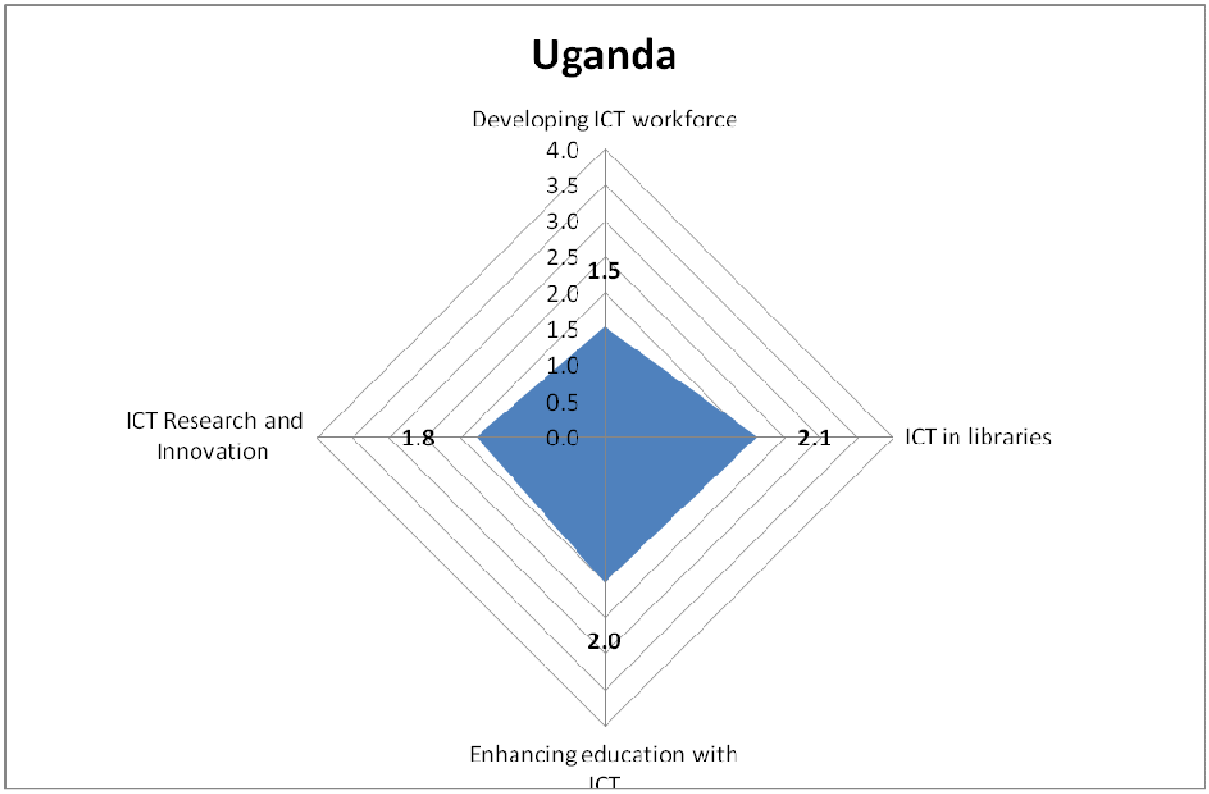


Figure 6.9: Networked learning indicator stages for Ugandan universities surveyed

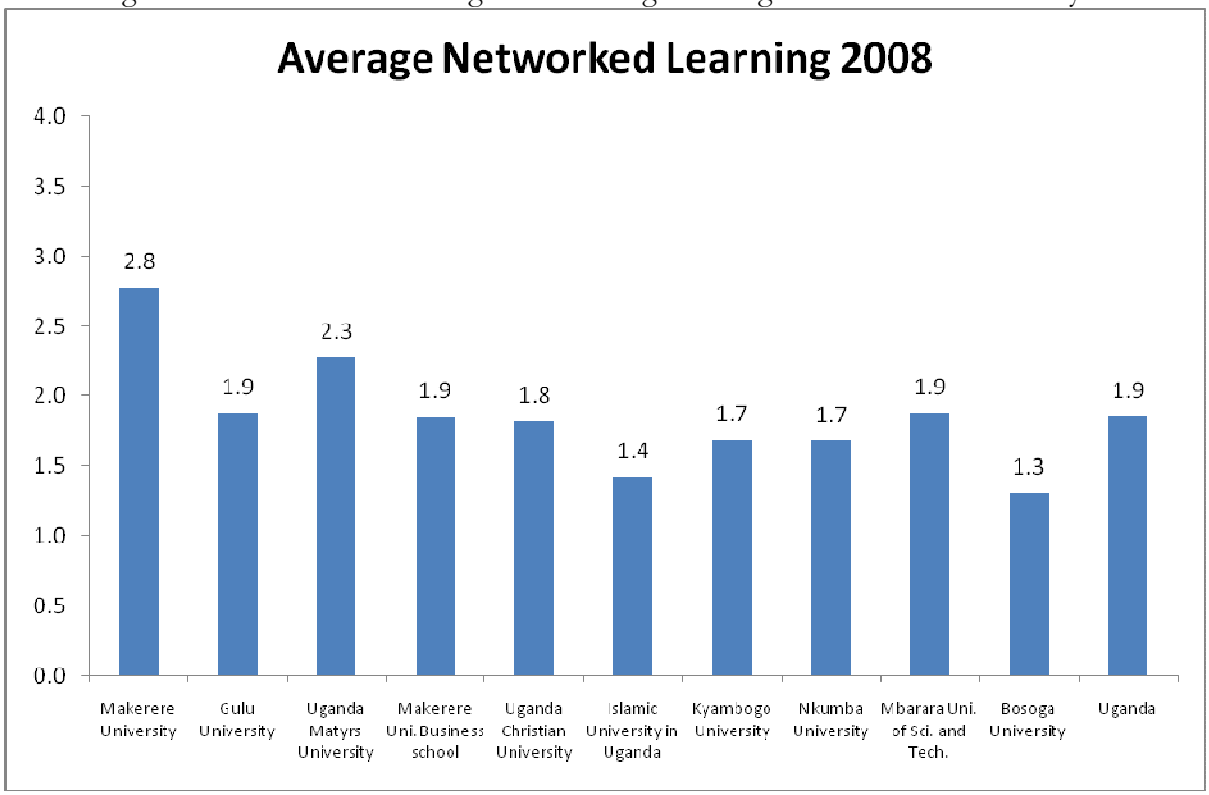


Figure 6.10: Networked learning everage staging for Ugandan universities

6.2.4 Networked learning indicators for Rwanda Universities

Figure 6.11 shows that the on average, the eight universities surveyed achieved stage 2 and above in enhancing education with ICT indicators but performed poorly in all the other indicators that

were below stage 2.0. It was surprising that the universities were only at stage 1.5 in developing ICT workforce indicator despite the country's focus on ICT as described in ICT context in Chapter 1 of this report. A score of 1.7 in ICT in libraries also suggests that most libraries were not yet automated and OPAC was not available.

Figure 6.12 giving an analysis of the eight universities surveyed indicates that only two universities, KIST and NUR were at stage 2.0 and above. None of the universities achieved stage 2.5 compared to the eight Kenyan universities that achieved stage 2.5 and above.

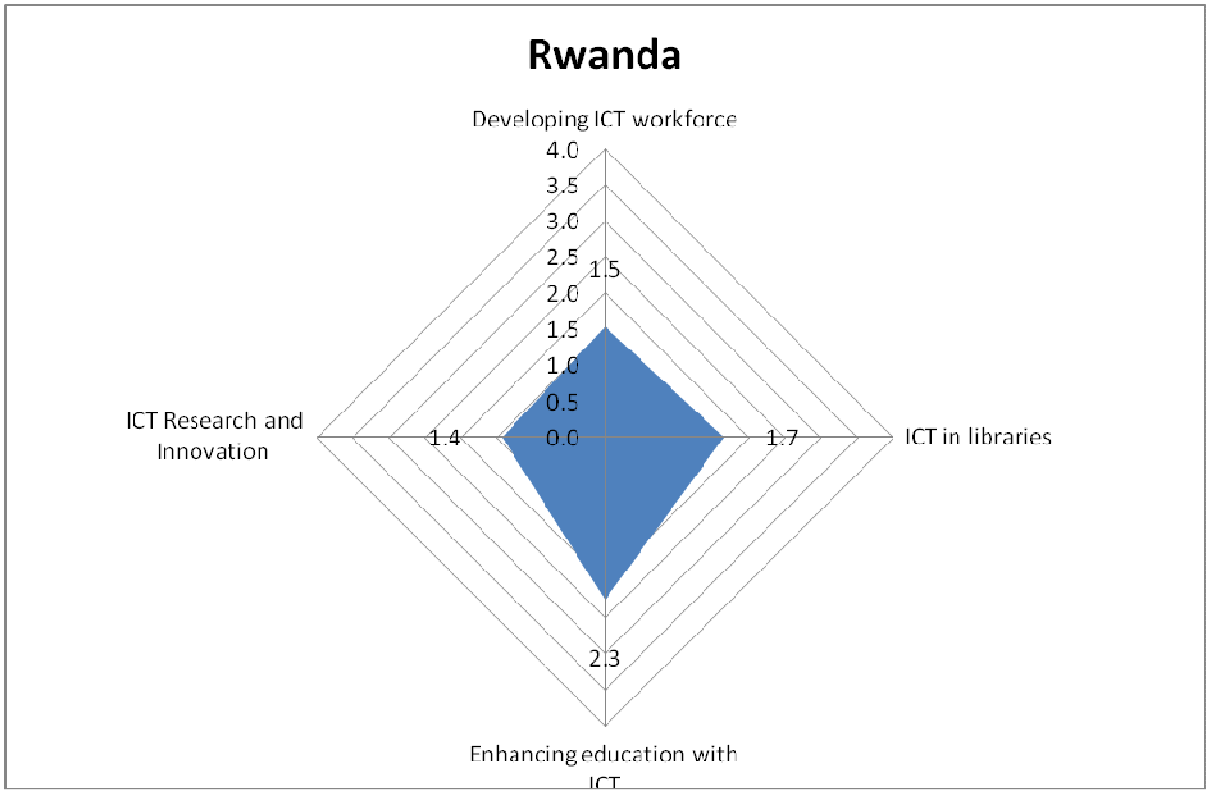


Figure 6.11: Networked learning indicators for universities in Rwanda

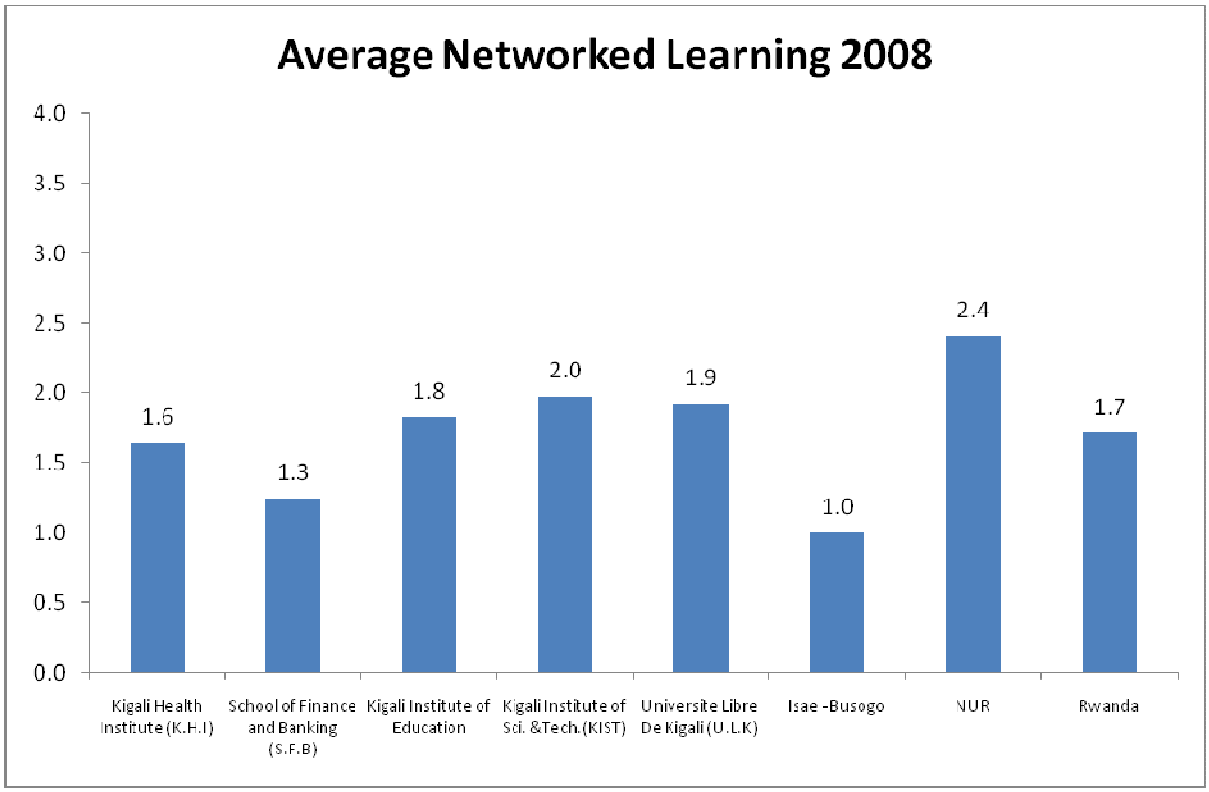


Figure 6.12: Networked learning stages for Rwanda Universities

6.2.5 Networked learning indicators for Burundi universities

Figure 6.13 shows that Burundi universities were below stage 2.0 in all indicators and below stage 1.5 in three of the four indicators (ICTs in libraries, developing ICT workforce and ICT research and innovation). This suggests that Burundi universities do not yet consider ICT to be of strategic value for teaching, learning, and research.

Analysis of the average stages in networked learning for the six universities surveyed in Figure 6.14 shows that only the University of Tanganyika and the Universite du Burundi were at stage 1.5 and above. One of these two universities will be included in the accession phase in this project.

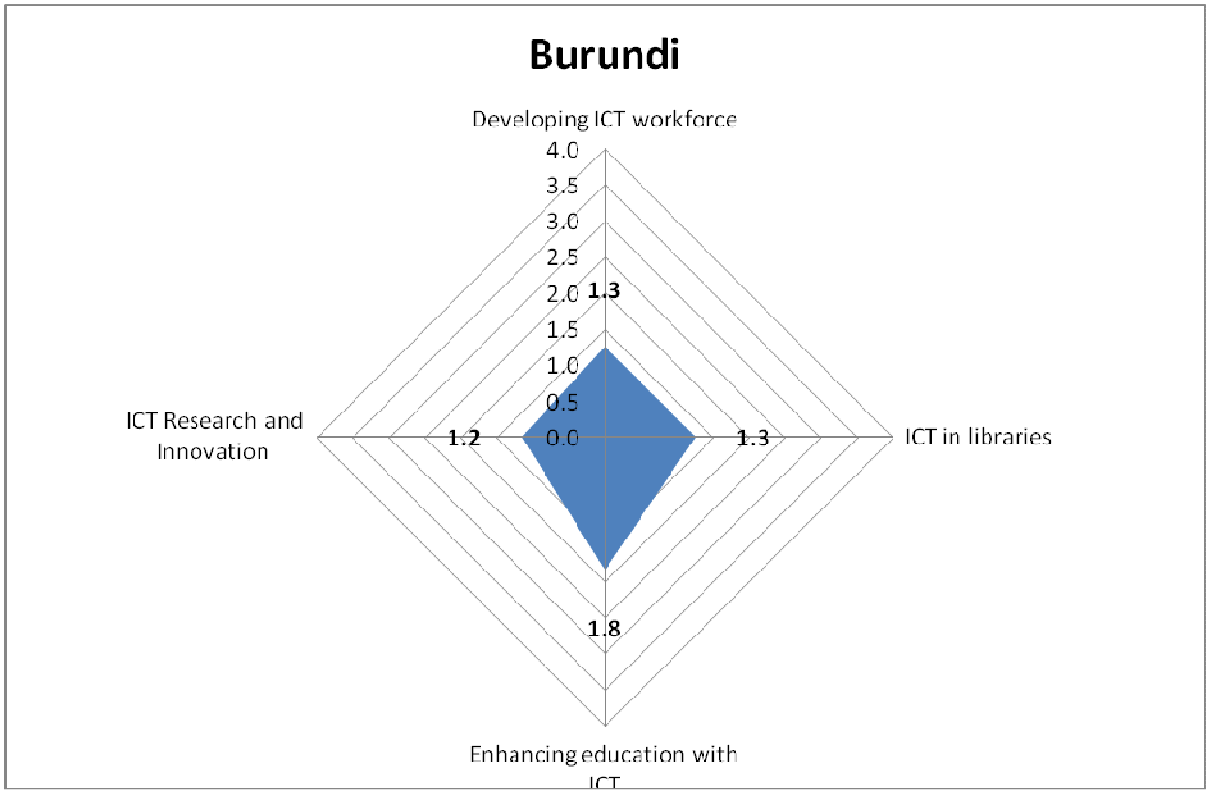


Figure 6.13: Average Networked Learning Indicator Stages for Burundi Universities

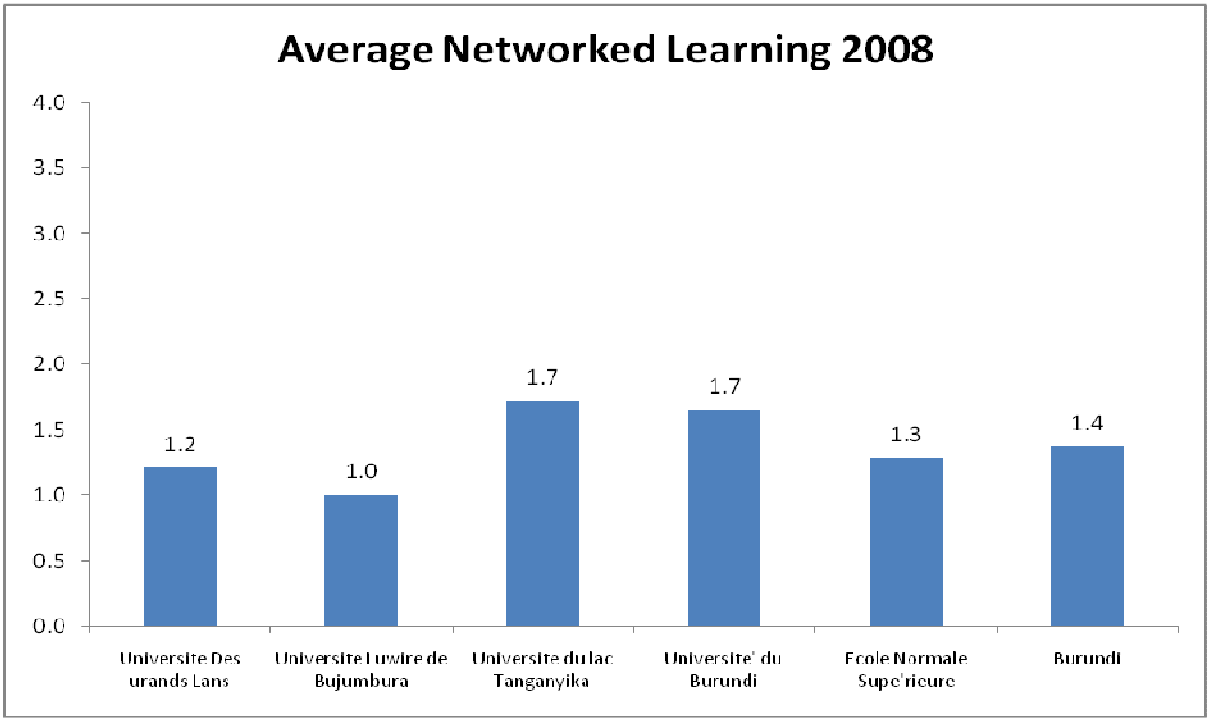


Figure 6.14: Comparison of Average Networked Learning Stages of Burundi Universities

6.3 Network Learning average staging by size

This section analyzes the effect of the size of the universities classified as follows: small (1000 – 2,500 students); medium (2,500 – 5,000 students); large (5,000 – 20,000 students); and very large (over 20,000 students).

Figure 6.15 compares the staging for each of the four indicators of networked learning category. The very large universities were consistently in higher stages than all the others. Similarly, the small universities were in the lowest stages in all indicators. As noted earlier, these findings were unexpected and will require further analysis.

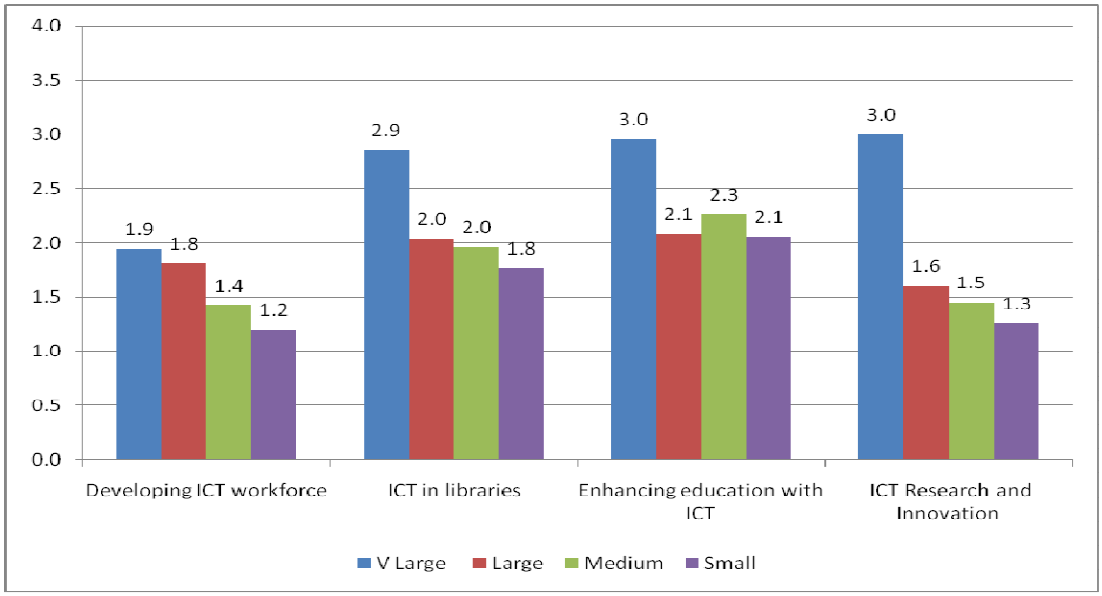


Figure 6.15: Comparison of network learning stages by university category

Figure 6.16 indicates that none of the small universities achieved stage 2.5. Moreover, only three of the 15 universities in this category were at stage 2.0 and above. This was a surprising result that seems to suggest that small universities were not ready to integrate ICT in learning and research.

The staging of the medium-sized universities shown in Figure 6.17 indicates that only two of the 20 universities in this category achieved stage 2.5 and above, namely, USIU and Strathmore University in Kenya. However, six out of the 20 universities were in stage 2.0 and above. Moreover, only one of the six universities was not Kenyan (i.e., DUCE in Tanzania). This shows that most of the universities with 5,000 students and below (35 of the 48 universities) are not yet ready to use ICT to support learning and research. These results require more detailed analysis to determine the reasons for low stages of readiness of this category of universities.

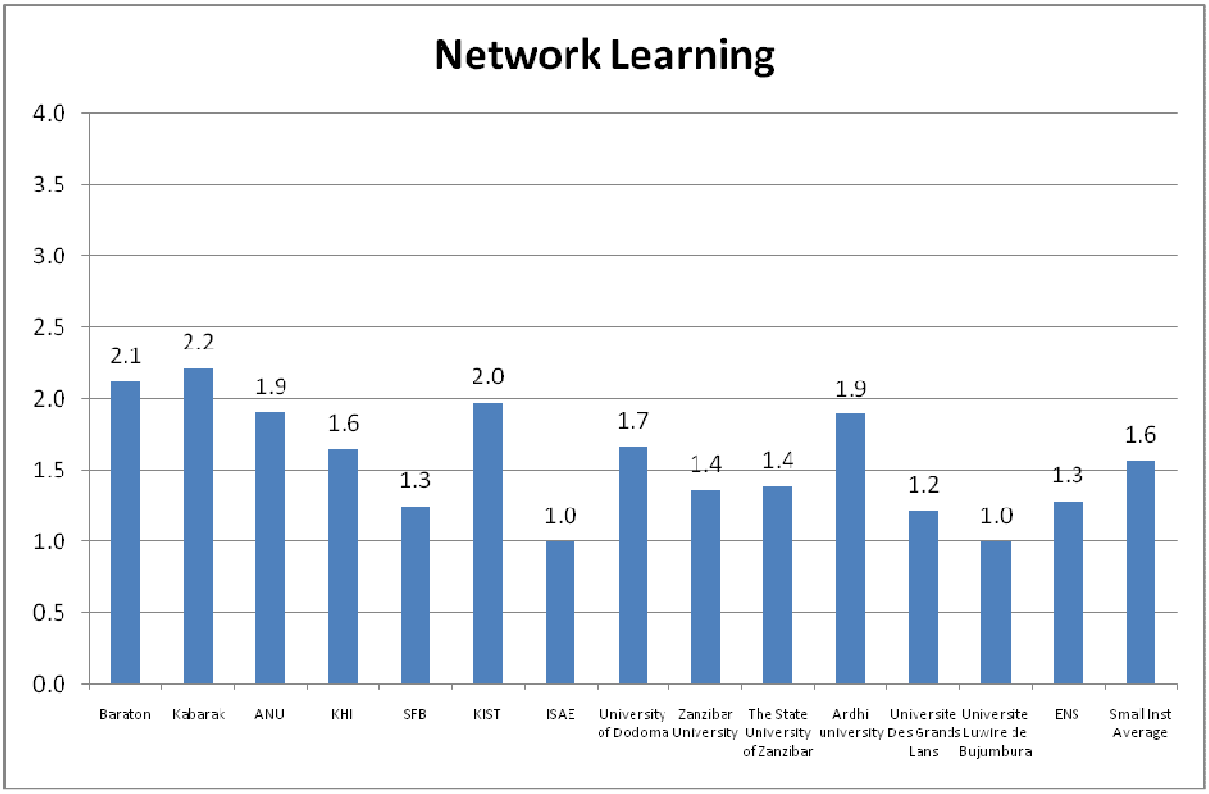


Figure 6.16: Networked learning staging for small universities (1,000 – 2,500 students)

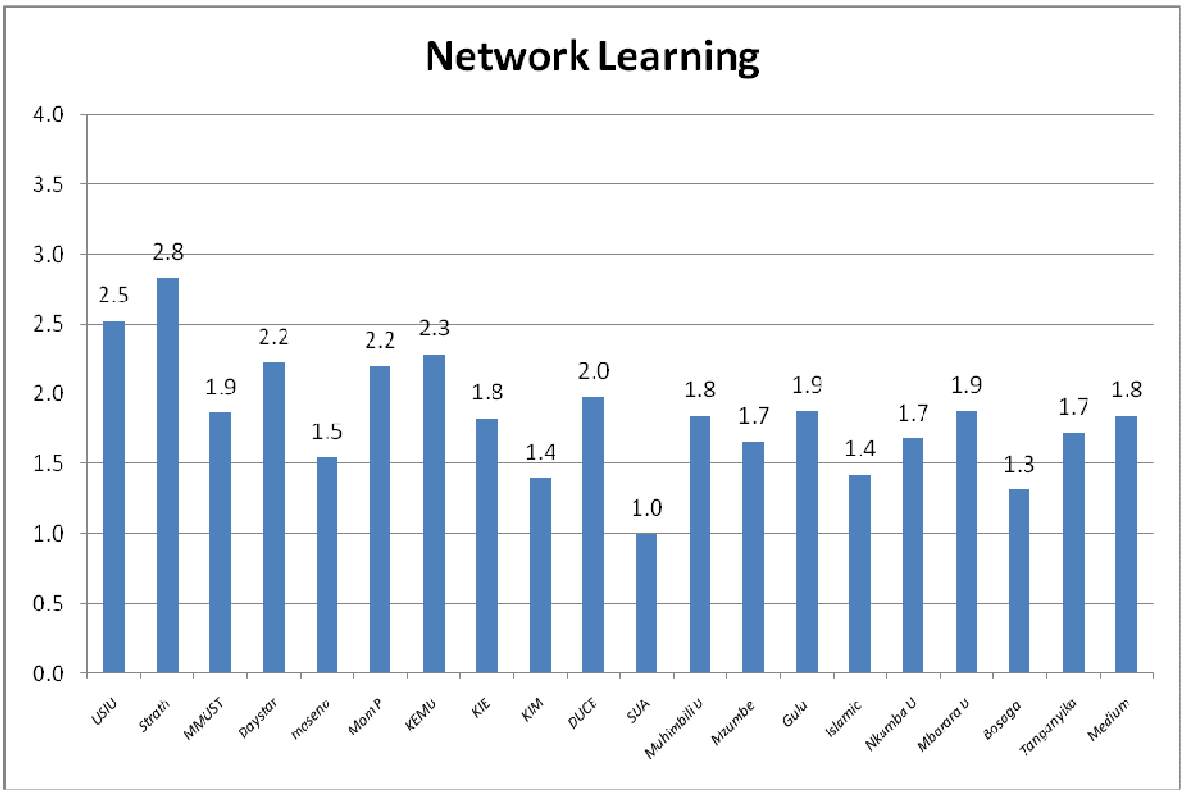


Figure 6.17 – Networked Learning Staging for Medium-sized universities

The staging for the large (5,000 – 20,000 students) universities and the very large universities (over 20,000 students) are shown in Figures 6.18 and 6.19 respectively. In this case, only four of

the 12 large universities were at stage 2.0 and above but only one was above stage 2.5 (JKUAT in Kenya). In comparison, all of the five very large universities were above stage 2.5 and the average for this category was stage 2.7.

It was apparent that the very large universities (also the oldest and well established) were most ready to take advantage of ICT to support learning, teaching and research. This is probably expected because it is the well established (and also very large) universities that have the critical mass of faculty with the capacity to transform teaching and learning using ICT and to conduct ICT research. However, a more detailed study is required to establish why the large universities, that are also well established, do not exhibit the same degree of readiness in networked learning. The development of the roadmaps for accession will consider the factor of size and concentration of qualified faculty in the different universities.

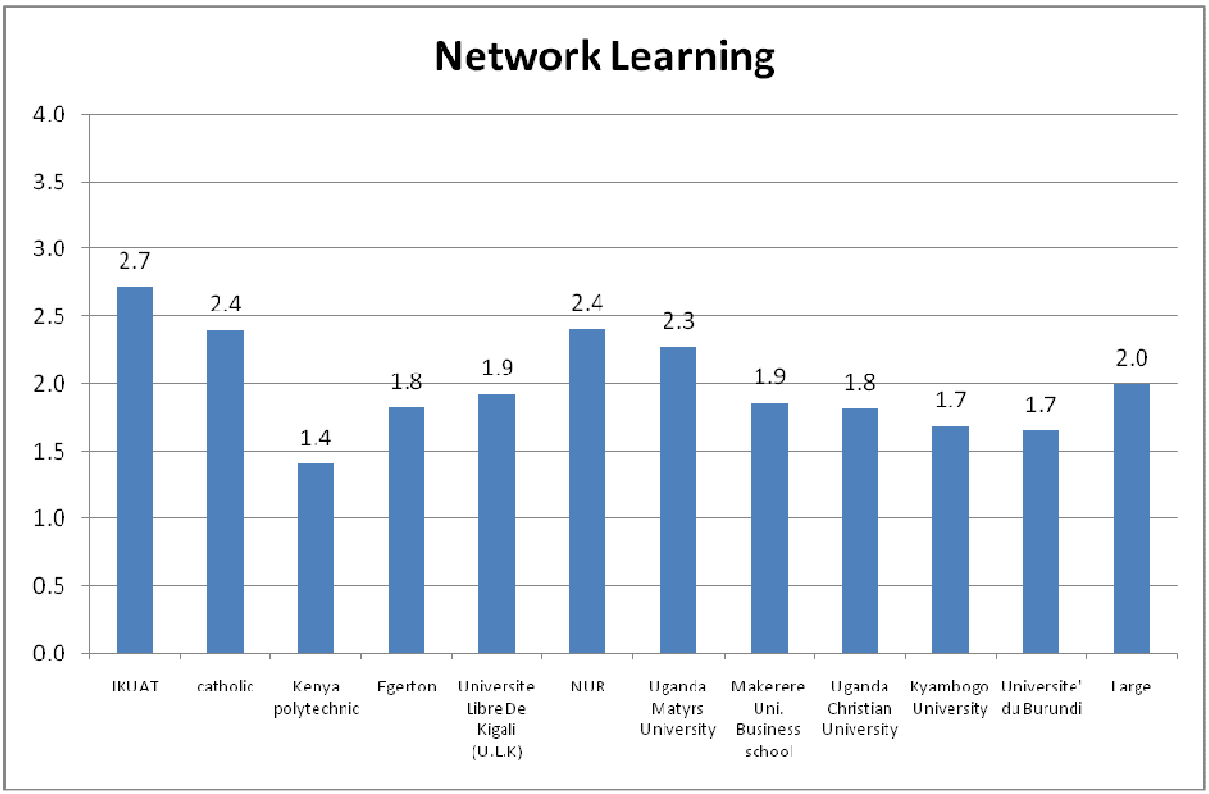


Figure 6.18: Networked staging for large universities (5,000 – 20,000 students).

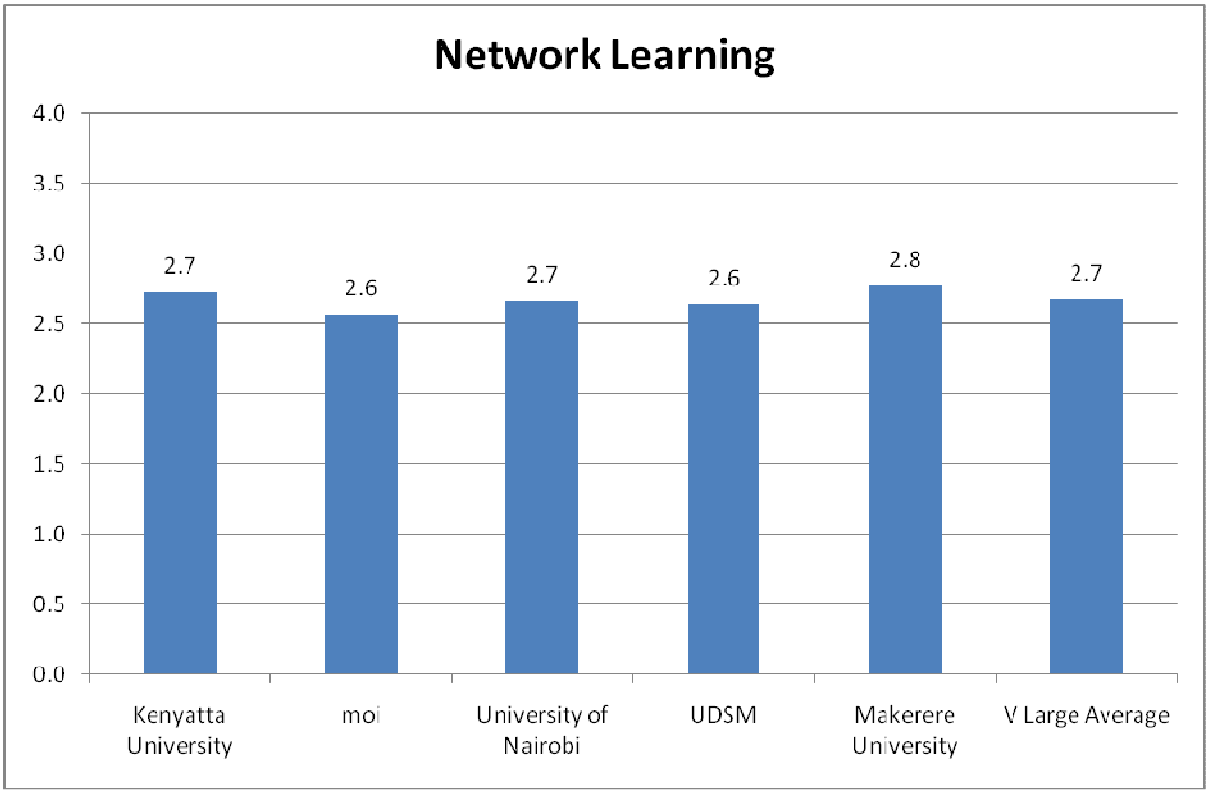


Figure 6.19: Networked learning staging for very large universities (over 20,000 students)

In summary, most universities in East Africa are yet to align ICT with learning in any significant way. Kenya is at a higher state of readiness in networked learning with eight universities out of the 17 surveyed being at stage 2.5 and above, including five of the large seven public universities. In Tanzania, only the University of Dar es Salaam was at stage 2.5 and above while in Uganda only Makerere University was at stage 2.5 and above (stage 2.8). Rwanda and Burundi did not have any universities in stage 2.5 and above.

7. NETWORKED SOCIETY

7.1 Networked society category of indicators

The networked society category consisted of the following indicators:

(i) People and organizations online
(ii) Locally relevant content
(iii) ICTs in everyday life
(iv) ICTs in the workplace

Each indicator was again sub-divided into sub-indicators that were then staged. The *people and organizations online* indicator measured the use of Internet resources for learning, research, news and entertainment. It assumed that users had access to e-mail as well as informational, interactive and transactional websites. E-mail accounts would be provided by either the universities or other ISPs.

The *locally relevant content* indicator measured the degree to which local online resources were available in higher education institutions and universities websites or other websites hosted in the specific country. These local websites would contain local news and entertainment or locally developed learning resources like databases or e-learning courses. It also measured the extent to which the country's Internet content had been locally developed and its relevance to the academic community.

ICT in everyday life indicator measured the readiness and use of a variety of ICT services and equipment by the academic community. For the purpose of this indicator, ICTs were defined broadly to mean computers, PDAs, mobile phones or fixed line phones, TVs and radios. Such ICTs equipment or services were not necessarily provided by the universities but would be available at cyber cafés or at home. Data for this indicator was collected using the field-based perceptions survey.

ICT in the workplace indicator was specific for academic and non-academic staff in universities. It measured the readiness and usage of ICT at the workplace. For academic staff, this meant using ICT for classroom presentations, preparing notes and e-learning content, for Web-based research, and for internal and external communication. Non-academic (administrative) staff, for example in an accounts department, would use institutional information systems for their daily work and to interact with suppliers, government, off-campus students and staff.

7.2 Overall staging of Networked Society indicators for East African universities

Figure 7.1 shows the average staging of the networked society category indicators for all the countries.

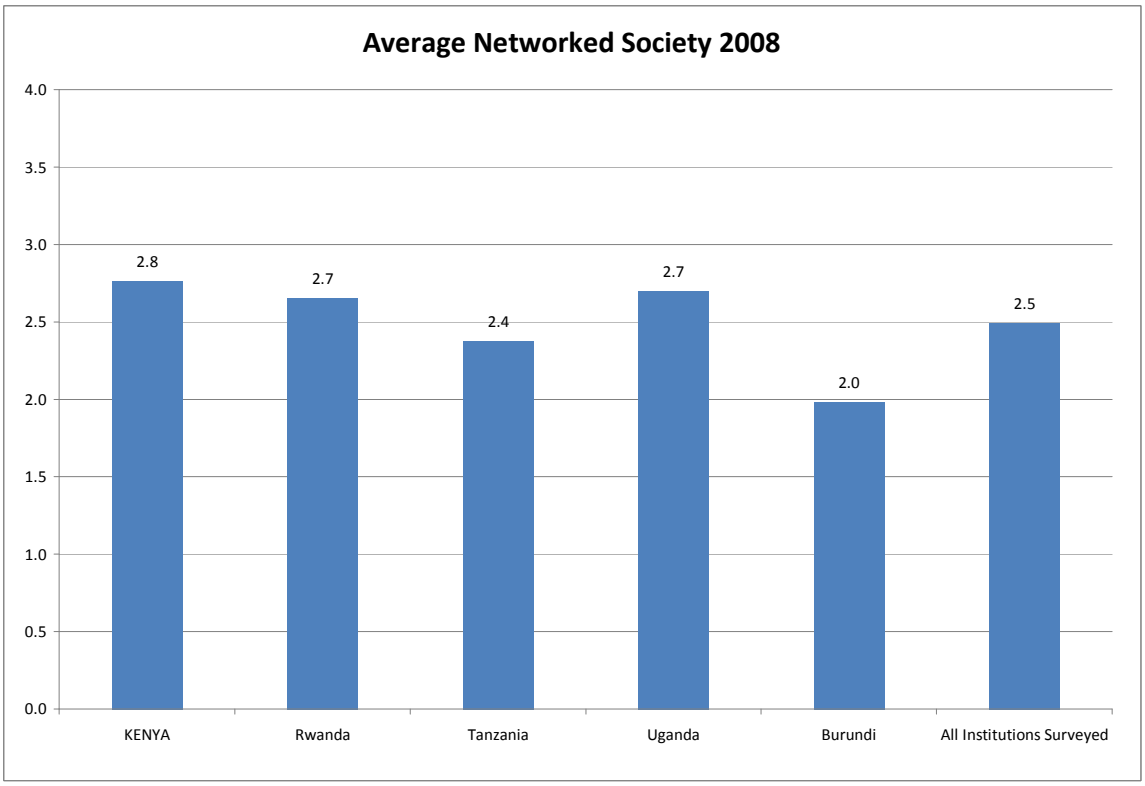


Figure 7.1: Average Networked society category for all countries

The overall stage for this category was 2.5, with Kenya scoring highest at 2.8 and the others countries scoring above 2.0. Kenya, Rwanda and Uganda were at stage 2.5 or better in all indicators, implying a relatively high degree of readiness by the academic community to use ICT for learning, teaching, and management.

The detailed staging for all sub-indicators is shown in Figure 7.2. It shows that all universities were close to stage 3 on locally relevant content. This meant that both faculty and student were accessing a significant amount of local content.

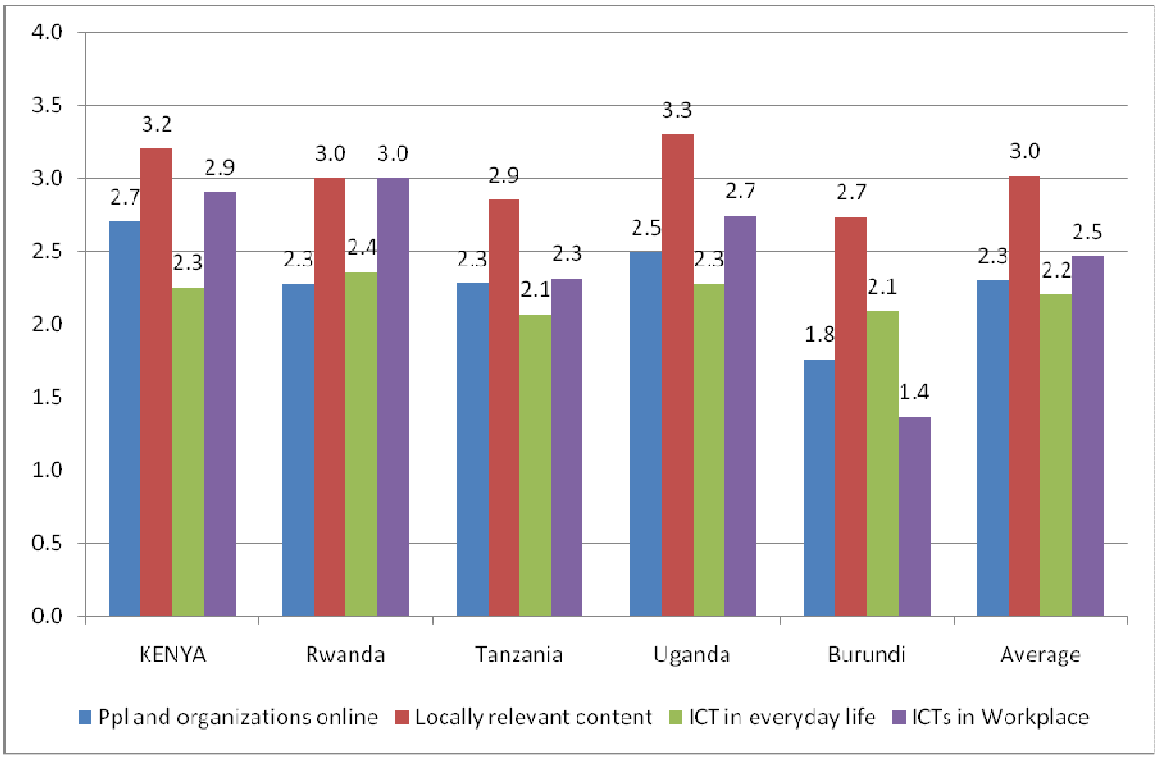


Figure 7.2: Average networked society category of indicators stages for all countries

Figure 7.2 that compares staging for the four indicators for the networked society category indicates that all countries scored above 2.0 for all indicators, except Burundi which scored 1.8 in people and organization and 1.4 in ICTs in the workplace. Stage 1.4 for ICTs in the workplace indicator implied that less than 25% of faculty and administrative staff used e-mail and the Internet. This may be explained by Burundi being at stage 1 in both network access and networked campus.

The following section analyzes the staging for each of the four indicators.

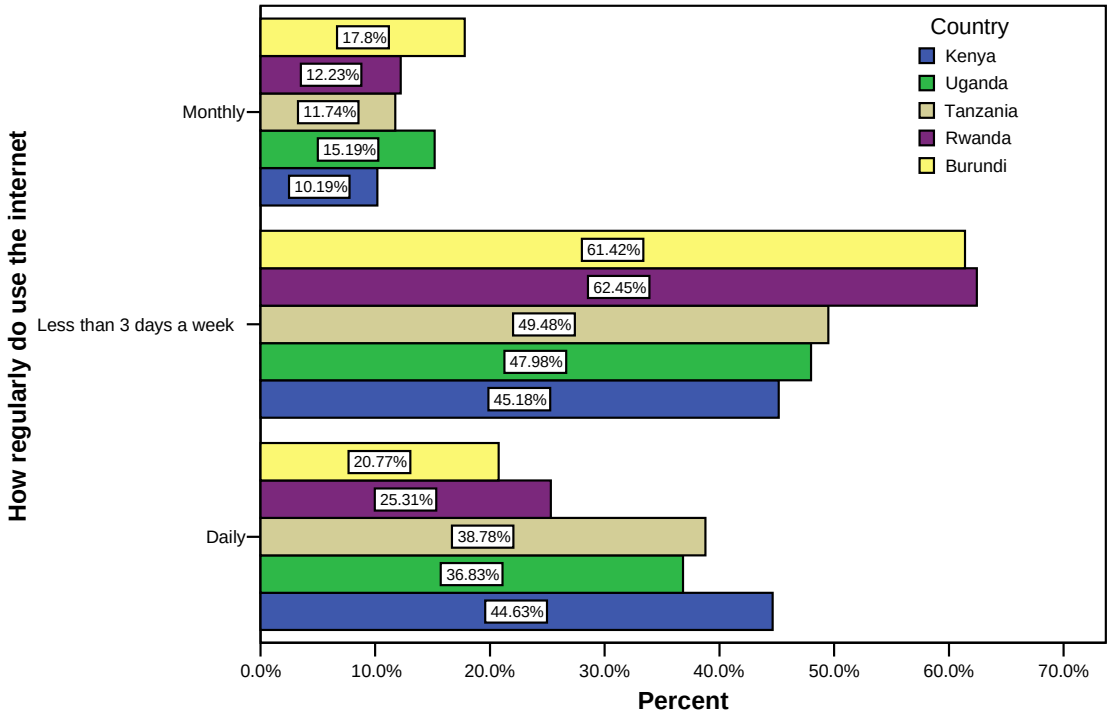
7.2.1 People and organizations online

The average for all universities for this indicator was 2.3, one of the lowest in the networked society category. As explained in Chapter 2, some of the sub-indicators used to stage this indicator included:

(i) Percentage of respondents using Internet and e-mail
(ii) Percentage of students and faculty who consider Internet as being most important for academic work
(iii) Percentage of students and faculty using Internet daily
(iv) Percentage of institutional websites considered by users to be interactive or transactional

This indicator therefore was determined by the campus online environment. The score of 2.3 suggested that staff and students in universities in East Africa had average access to online resources in their campus networks. None of the countries was placed at stage 4, which required daily use of the Internet by 50% of the students. Kenya had the highest score with about 45% of

the students using the Internet daily (see Figure 7.3) compared to 30% recorded in 2006 survey. Rwanda and Burundi scored poorly, with over 60% of the student respondents reporting using the Internet for less than three days per week. On average, more than 10% used the Internet once a month, which is rather low usage. In Kenya, 10.2% student respondents used the Internet once a month, which was an improvement from the 19% recorded in the 2006 survey. This indicated that Internet usage in Kenyan universities had increased over past two years.



Source: KENET 2008

Figure 7.3: Frequency of use of Internet

7.2.2 Internet usage by gender

An analysis of usage of the Internet by gender shows that 48.8% of male respondents used the Internet daily compared to slightly less for female respondents (Figure 7.4). The percentage of male respondents who used the Internet less than three days a week was 48.3% and slightly more for female respondents. Only about 10% of male respondents reported that they used the Internet at least one a month compared to slightly more female respondents.

On usage of mobile Internet, there were slightly more male respondents (50%) compared to female respondents (47%) as shown in Figure 7.5. Therefore there is no significant difference between the two genders in terms of Internet use.

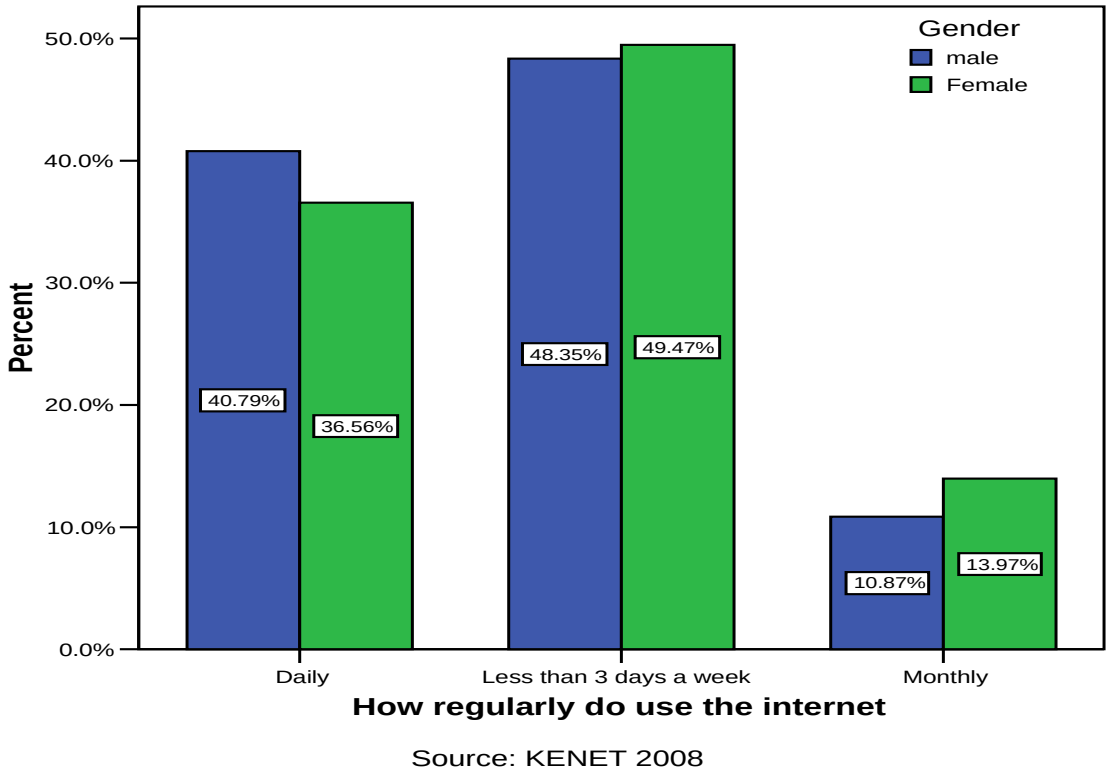


Figure 7.4: Frequency of Internet use by gender

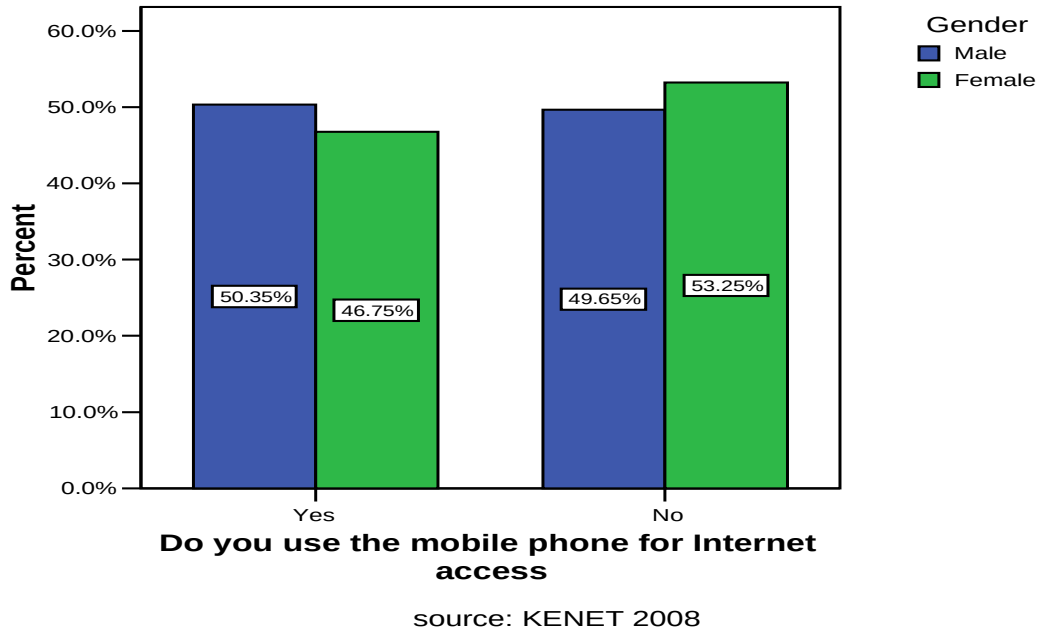


Figure 7.5: Percentage of staff and faculty using mobile Internet by gender

Another sub-indicator of Internet usage was percentage of respondents who visited at least one Web portal regularly. Figure 7.6 shows that about 32% of the female respondents did not visit any Web portals compared to 29% of male respondents. Although percentage with e-mail addresses was fairly similar across the gender, on the whole, the results suggested that the male respondents were more intense users of the Internet than female users. This is an area that requires further investigation to determine reasons for the differences in intensity of Internet use by gender.

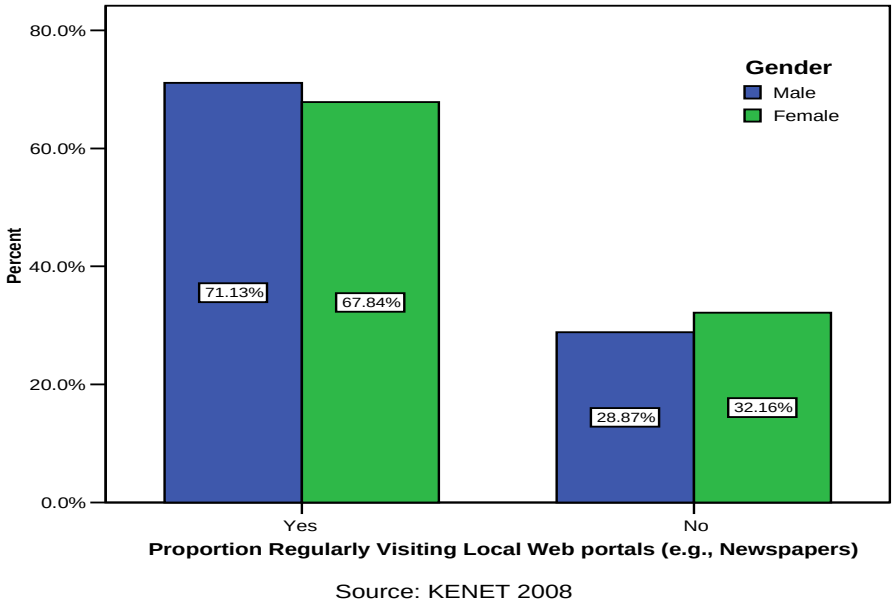
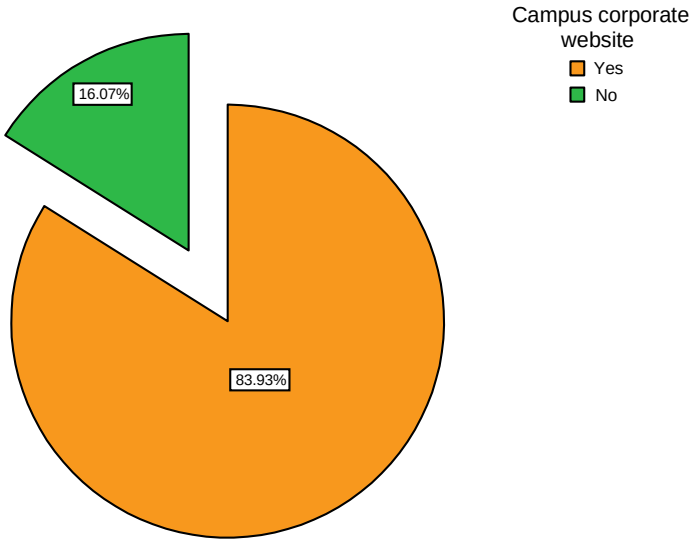


Figure 7.6: Regular visit to Web portals by gender



Source: KENET 2008

Figure 7.7: Campuses with corporate websites

About 16% of the universities did not have a corporate website as shown in Figure 7.7. Although over 50% of the users surveyed (57% staff and 53% students) classified their websites as informational, Figure 7.8 shows that over 15% of staff and 28% students did not know the type of websites hosted by their universities. This suggested that there was a significant proportion of respondents who had never visited their institutional websites. Figure 7.8 also shows that less than 28% of staff and 18% of students classified their websites as interactive. Stage 4 in this indicator required that 75% of the websites were interactive according to this staging framework [Kashorda and Waema, 2008]. To achieve stage 4 of this sub-indicator, the universities surveyed will have to develop interactive websites.

Source: KENET 2008

Figure 7.8: Classification of institutional websites by users

Universities in East Africa could improve the stage of this indicator by simply building interactive websites. However, it would require automating their internal processes and establishing operational information systems (e.g., student information systems, financial information systems or other enterprise resource planning (ERP) systems). The analysis later in this report shows that this is an institutional leadership challenge for most of the universities surveyed (see Chapter 9 on Institutional Strategy category of indicators).

7.2.3 ICTs in everyday life indicator

The key sub-indicators for the ICTs in Everyday life were:

(i) Percentage of students and faculty with campus access to computers
(ii) Percentage of students and faculty using computers for Internet/e-mail
(iii) Percentage of students whose main access to computers is the cyber café
(iv) Percentage of students and faculty using computers for e-mail, word-processing and data analysis

The overall score of the ICT in everyday life was 2.2, which suggested limited use of ICT by students and faculty. Most of the students and faculty reported that they did not have access to computers at home or on campus and had to use cyber cafés. For example, Figure 7.9 shows that over 50% of the students' accessed computers and the Internet in cyber cafés. Only 8% of the students reported their primary access to computers was on campus. This is a very interesting finding and represents a challenge for the universities in the region, especially for e-learning. The inconvenience and cost of accessing Internet and computers in cyber cafés may explain the relatively low use of Internet resources for learning.

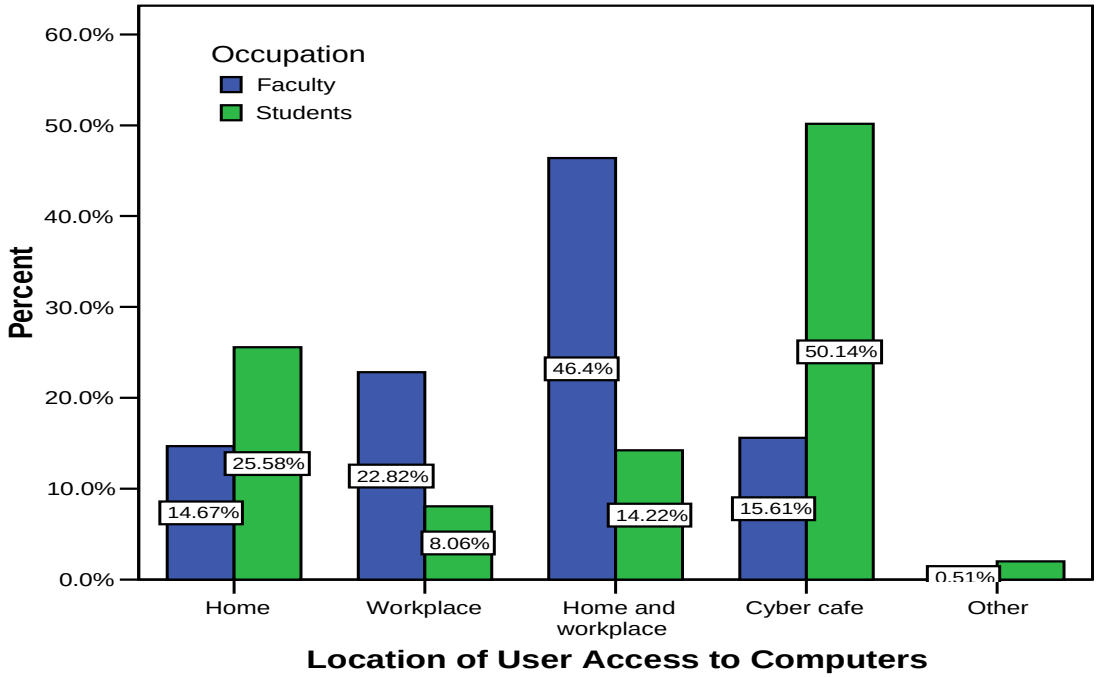
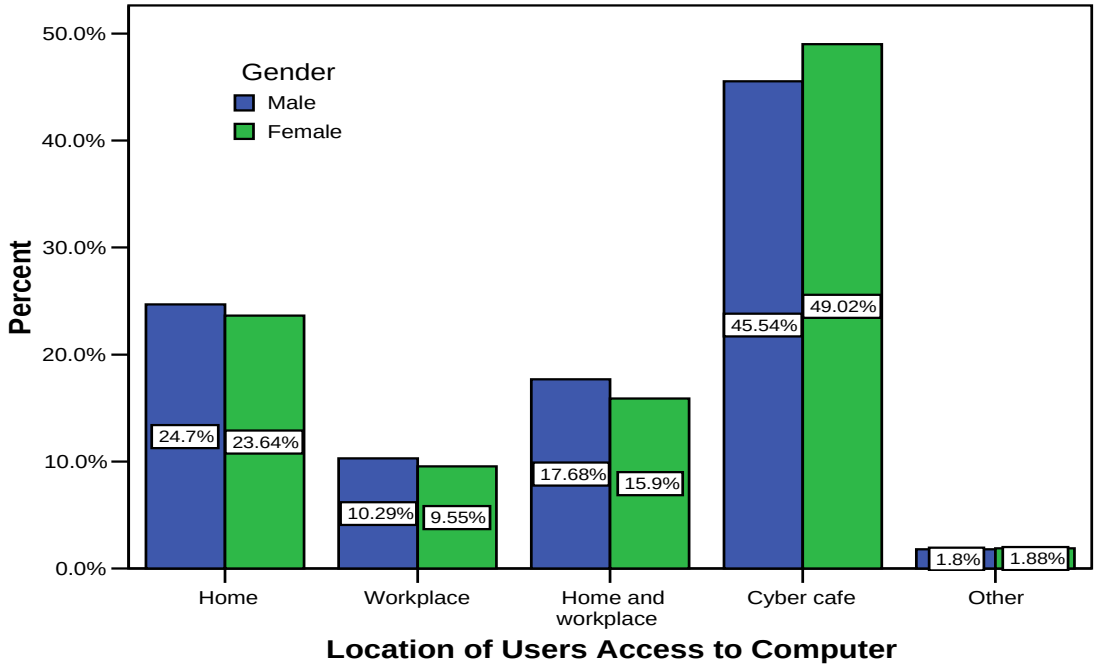


Figure 7.9: Location of user access to computers

Location of computers and Internet by gender

Concerning the gender dimension of access to computers 49% of female respondents reported to access computers at cyber cafés compared to 45.5% of the male students, as shown in Figure 7.10. This was a surprising result considering that cyber cafés are often off-campus. The difference between the female and male respondents (students and staff) on campus and at home was much less. For example, only 9.6% of the female respondents reported that their primary access to computers was on campus compared to 10.3% for male respondents.

The results shown in Figures 8.9 and 8.10 were consistent with the low stages of the network access indicators (e.g., Internet availability). It was evident that students and staff were ready to pay for Internet services in cyber cafés.



Source: KENET 2008

Figure 7.10 Location of user access to computers by gender

Purpose for using computers

Table 7.1 shows the purposes for using computers by faculty, administrative staff and students for all the countries. In all countries, the majority of faculty and administrative staff used computers primarily for Internet and e-mail, except in Uganda where the most popular usage was word processing. For students, the most popular use for computers was the Internet and e-mail for all countries. Stage 4 in the percentage using computers for Internet/e-mail sub-indicator required that 75% of users used computers for this purpose. Only Rwanda and Burundi were at stage 4 for both faculty and administrative staff. Burundi was the only country at stage 4 for students. The rest of the countries were at stage 3 for all categories of users.

A very high proportion of faculty members used computers for word-processing and data analysis in all countries. Stage 4 in percentage using computers for word processing sub-indicator required that 75% of users used computers for this purpose to prepare teaching materials or for assignments (i.e., learning or teaching related purposes). Only Burundi was at this stage for faculty only. The rest were either at stage 2 or 3.

Table 7.1 Purpose for using computers by faculty, staff and students

Occupation/Country		Purpose for using Computers (%)				
		Word Processing	Data Analysis	Email/Internet	Entertainment	Others
Faculty	Kenya	48.0	60.9	70.2	35.6	1.5
	Uganda	73.3	66.0	65.1	42.1	0.6
	Tanzania	48.2	51.1	60.3	37.2	0.4
	Rwanda	59.1	72.7	86.4	45.5	2.3
	Burundi	83.3	66.7	83.3	33.3	0.0
Admin staff	Kenya	50.1	51.4	72.5	38.3	0.8
	Uganda	72.1	57.9	66.8	46.8	1.1
	Tanzania	40.2	50.2	56.8	32.8	0.9
	Rwanda	70.0	57.5	82.5	23.8	1.3
	Burundi	63.2	36.8	84.2	57.9	5.3
Students	Kenya	42.9	33.5	72.9	52.4	1.8
	Uganda	57.9	35.2	61.0	55.9	0.7
	Tanzania	42.3	39.8	58.8	37.4	1.1
	Rwanda	45.3	46.6	86.6	36.6	0.9
	Burundi	41.8	10.7	70.9	50.8	0.0

Mobile Internet usage by faculty and staff

Results of the survey showed that over 96% of students, faculty, and staff had access to mobile phones. It is likely that this would be the dominant ICT device for accessing online resources in future, given the high penetration of mobile communication in the region. Figure 7.11 shows that 45% of faculty members used mobile Internet services, compared to 25% in the 2006 survey in Kenya. The results further showed that over 60% of users in Kenya and Tanzania used the mobile phone for Internet access (Figure 7.12) and 45% in Uganda. This illustrates how quickly mobile Internet is growing in the region. For example in Kenya, by 2008, mobile teledensity was over 35% compared to fixed telephone teledensity of about 1%[1]. It was however surprising that only a small percentage of users in Rwanda and Burundi used mobile phones for Internet access, at 19% and 13% respectively.

[1] http://www.cck.co.ke

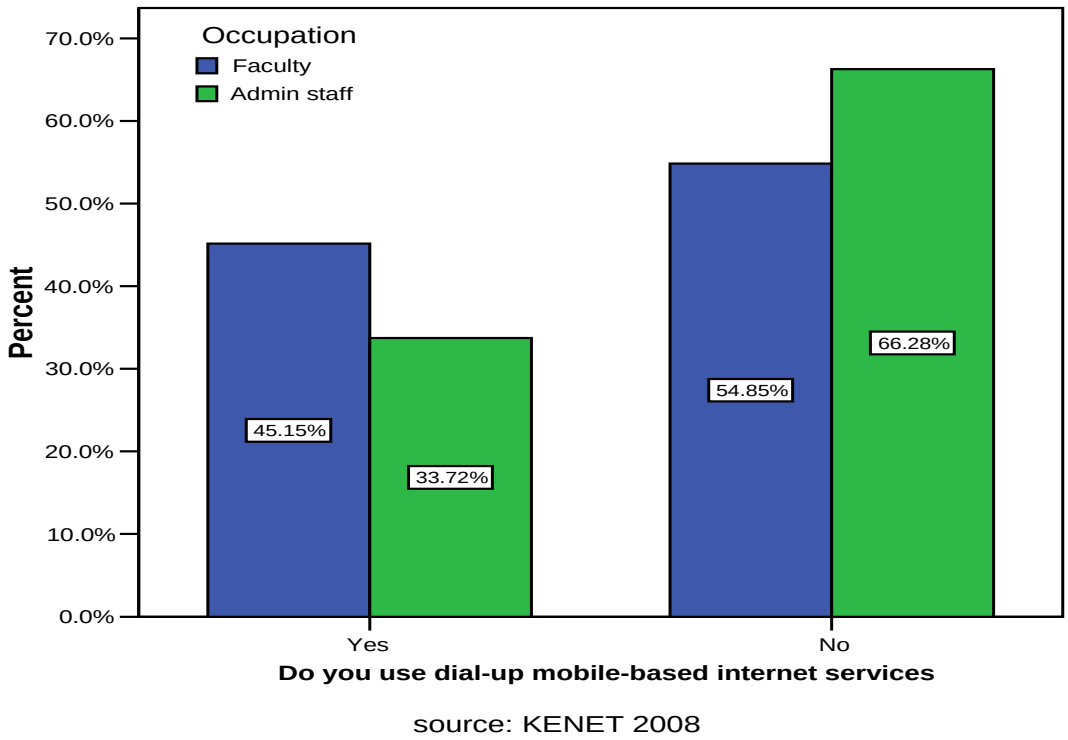


Figure 7.11: Mobile Internet usage by faculty and staff

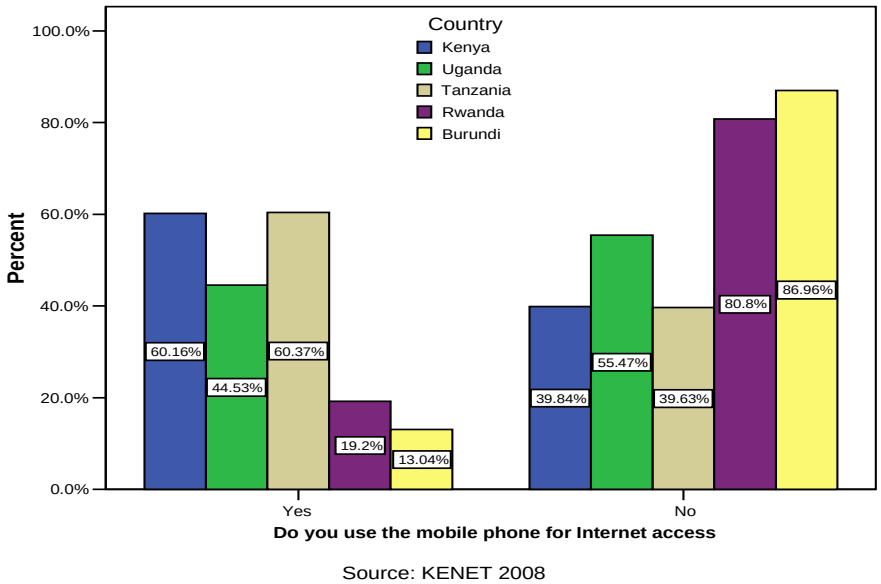
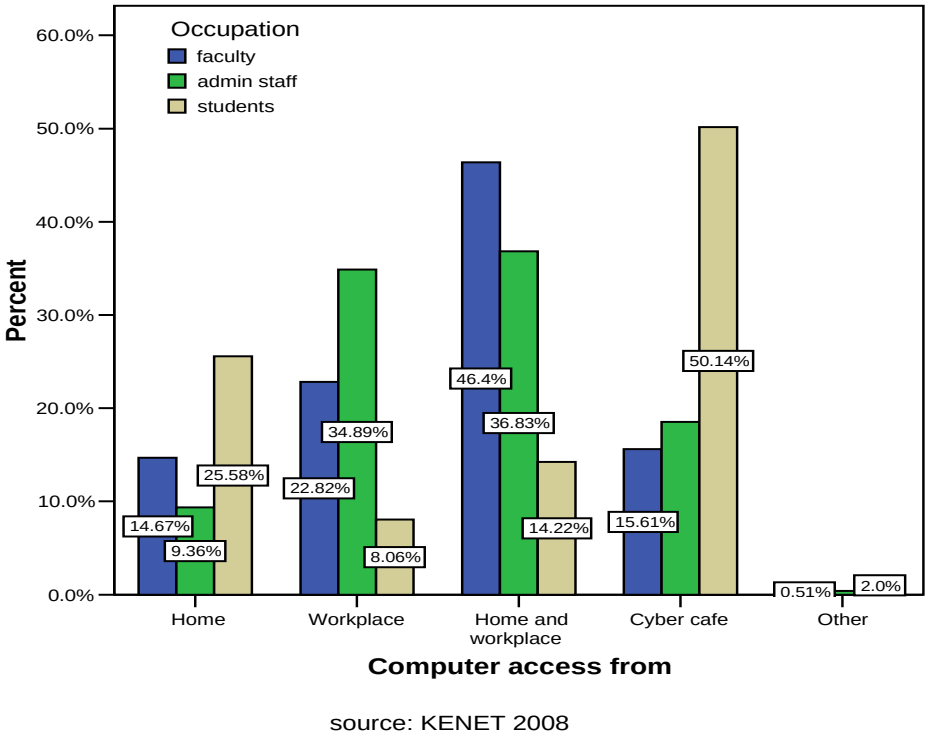


Figure 7.12: Mobile Internet usage by country

7.2.3 ICTs in the Workplace

The average for this indicator was stage 2.5, which from the framework means that 25% to 49.9% of users used computers at the workplace. This was confirmed by the results that only 23% of faculty reported having access to computers in their offices and about 35% of non-teaching staff as shown in Figure 7.13. This was also supported by the findings that about 54% of respondents had off-campus access to e-mail; about 27% thought on-campus e-mail always worked and 45% and 56% of faculty and students respectively thought that Internet speed on campus was worse than cyber cafés or other ISPs. This demonstrates that on average, universities have not invested sufficiently in computers for staff and faculty and the quality of the infrastructure was poor.



source: KENET 2008

Figure 7.13: Location of user access to computers

Internet use by academic departments

Table 7.2 shows that access to Internet by faculty was not uniform for all departments in universities in some countries. Kenya demonstrated fairly uniform access, which is an improvement from 2006 where 53% of faculty members in education departments could not access the Internet from an office computer and faculty in professional degree programs generally had lower access to the Internet from their offices. While Tanzania showed fairly uniform access by all academic departments, Uganda demonstrated non-uniformity in access. For example, engineering, biological and physical sciences and education departments had particularly lower access to computers than other departments. Although Rwanda and Burundi showed varied uniformity, data from some departments was not collected. In general, the reasons for the apparent digital divide in academic departments in some universities require further investigation.

Table 7.2 Faculty Academic Departments access to internet from office computers

Academic Department	Kenya	Uganda	Tanzania	Rwanda	Burundi	**Overall**
Human and Social Sciences	81.5	77.3	94.4	100.0	0.0	**85.2**
Languages, Communication, Journalism	84.0	87.5	82.4	0.0	0.0	**84.0**
Computing (IT, IS, CS, CE)	92.5	84.2	90.9	100.0	0.0	**90.8**
Engineering (Electrical, Mechanical, Civil)	81.8	34.0	93.3	0.0	0.0	**57.1**
Biological Sciences, Physical Sciences	75.8	45.5	92.3	50.0	0.0	**76.4**
Education	82.4	55.6	91.3	33.3	0.0	**77.9**
Medical Sciences	78.6	75.0	85.7	100.0	100.0	**81.5**
Business or Commerce	94.7	64.3	90.5	50.0	100.0	**83.3**
Other	71.4	88.2	100.0	100.0	0.0	**86.2**
Not stated	73.7	90.7	100.0	100.0	0.0	**81.6**
Overall	**83.0**	**67.3**	**91.8**	**84.6**	**50.0**	**80.7**

The results also show that only about 35% faculty respondents stayed online for about one hour per day. According to the staging framework, this was stage 3 for ICTs in the workplace indicator. Stage 4 for this sub-indicator required that 50% of faculty spend more than one hour online per day researching, reading, or communicating.

7.2.4 Locally Relevant Content indicator

Key sub-indicators used for staging the locally relevant content included:

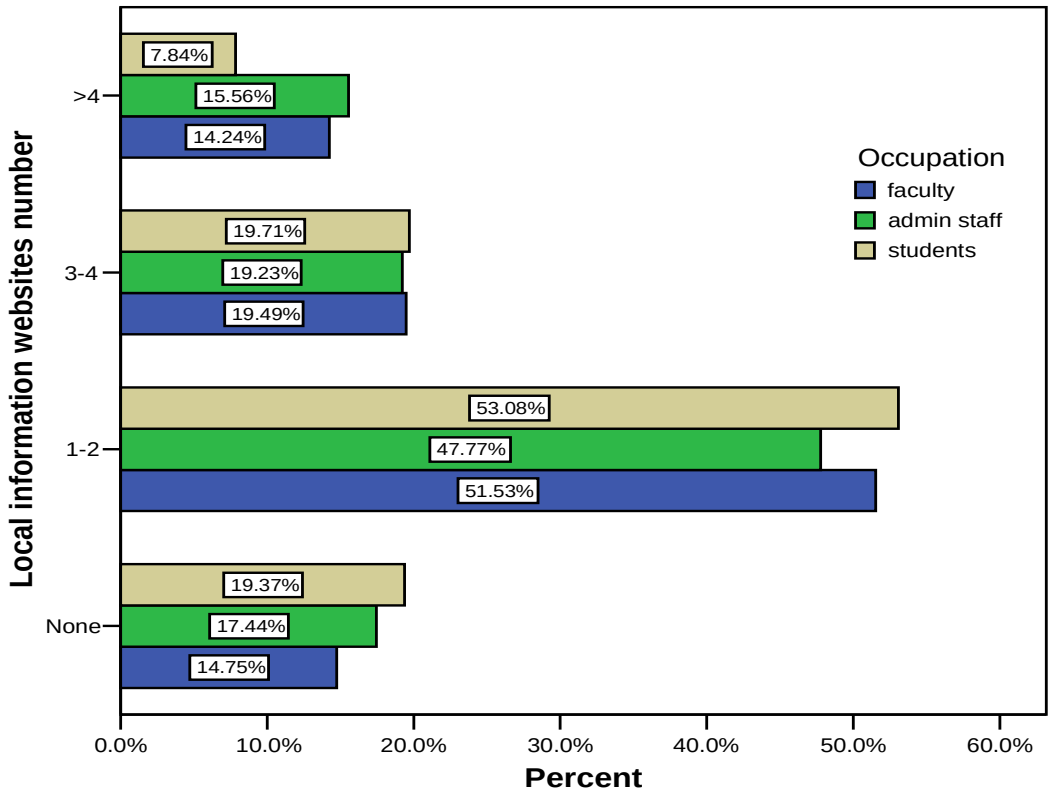
(i) Percentage students and faculty visiting 1-2 local websites
(ii) Percentage of students and faculty visiting local Web portals with national information
(iii) Percentage of students looking for local news and entertainment
(iv) Percentage of students looking for academic information from local websites

The overall score of 3.2 for this indicator suggested that students and faculty searched for local content for news and entertainment and for academic information.

Percent of students and faculty visiting local websites sub-indicator

Figure 7.14 shows the percentage of students, faculty, and staff visiting local websites. About 19% of the student respondents did not visit any local websites, while 53% reported regularly visiting one or two local websites (i.e., contain local information). About 52% of faculty respondents visited one or two local websites and only 14.75% did not visit any local websites.

Stage 4 for these sub-indicators required that 50% of students or faculty visit at least one or two websites. This meant that students, faculty, and staff were all at stage 4 in these sub-indicators.

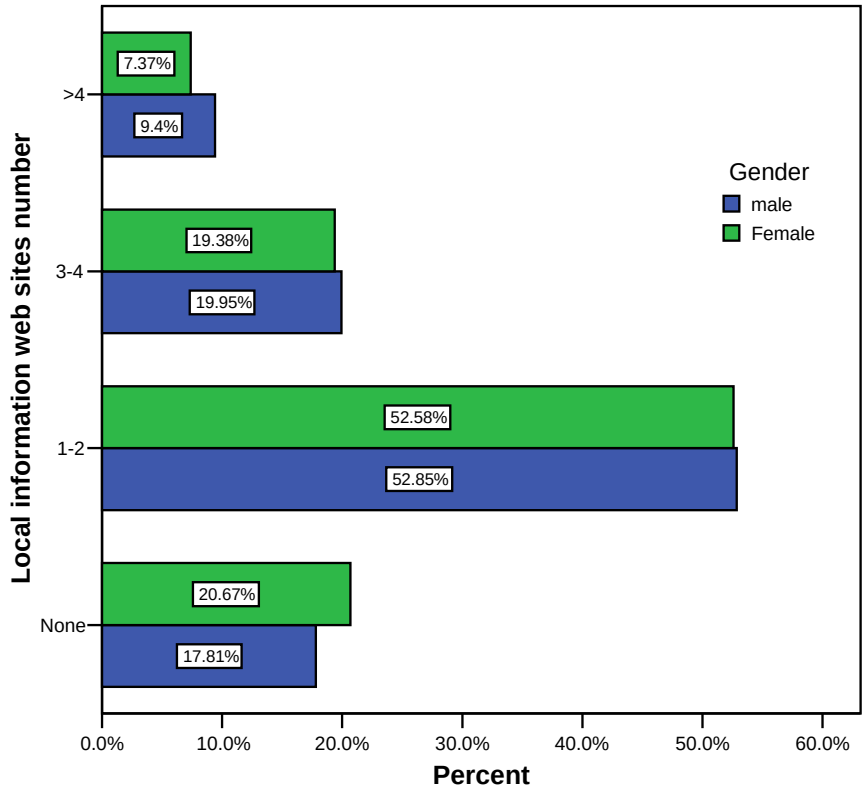


source: KENET 2008

Figure 7.14: Local websites visited by the users

Percent of respondents visiting local websites by gender

Figure 7.15 shows that about 21% of female respondents did not visit any local websites compared to about 18% of male respondents. However, the percentage of those visiting one or two local websites was the same (about 53%). This means that both female and female respondents were at stage 4 in this sub-indicator. The results also showed that only 7% of female respondents visited more than four local websites compared to 9% of male students. Although both male and female respondents were at stage 4, these results suggest that male students were more intense users of local Internet resources.



source: KENET 2008

Figure 7.15: Local Websites visited by users by gender

7.3 Networked society average stages of Kenyan universities

Figure 7.16 compares the average staging of networked society category of indicators for Kenyan universities in 2006 and 2008. It shows that most universities have maintained the same performance or gone slightly lower in performance. However, all the universities were at stage 2.5 or above, with private universities performing better than public universities. The overall staging was 2.8, an illustration that the community is ready to use ICT for learning and at the workplace for academic work and management.

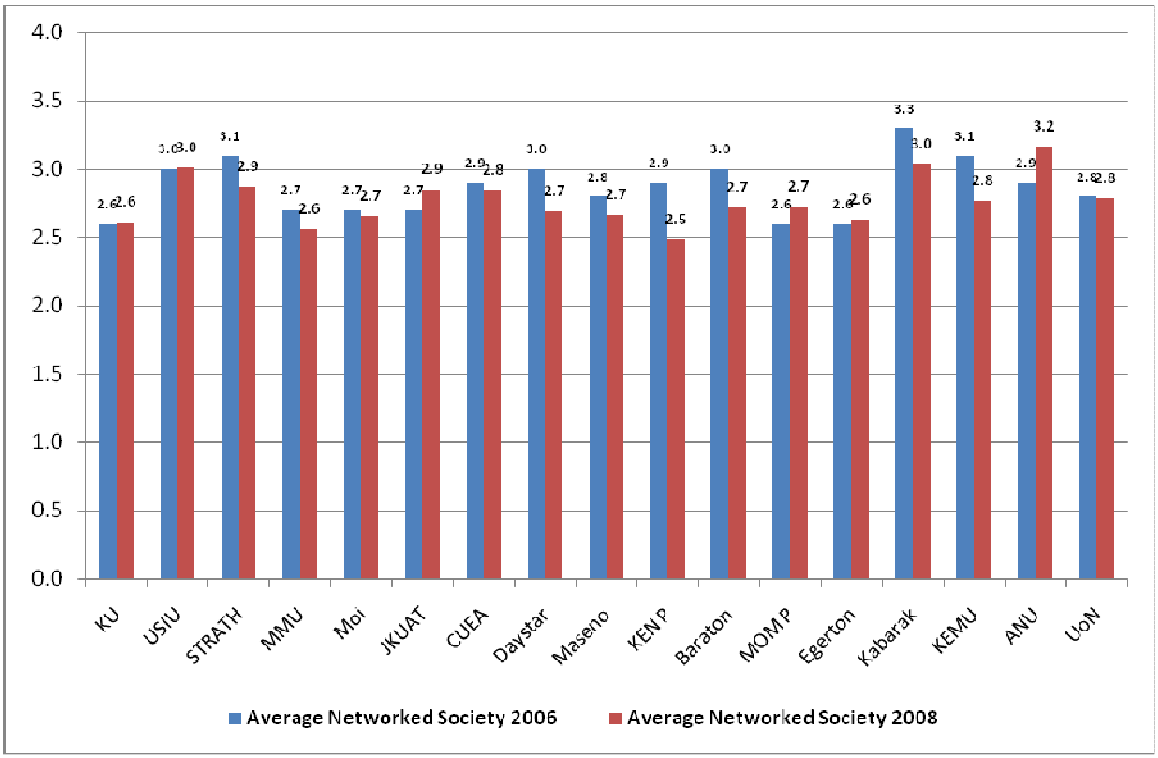


Figure 7.16: Comparing networked society staging in 2006 and 2008

7.4 Networked society average stages of other East African Universities

As shown in Figure 7.17, most universities in Uganda were at stage 2.5 or above except for Gulu and Kwambogo. As observed in Kenya, private universities performed better than public universities. The overall staging was 2.7, as in Kenya, an illustration that the academic community was ready to use ICT for learning and at the workplace for academic work and management.

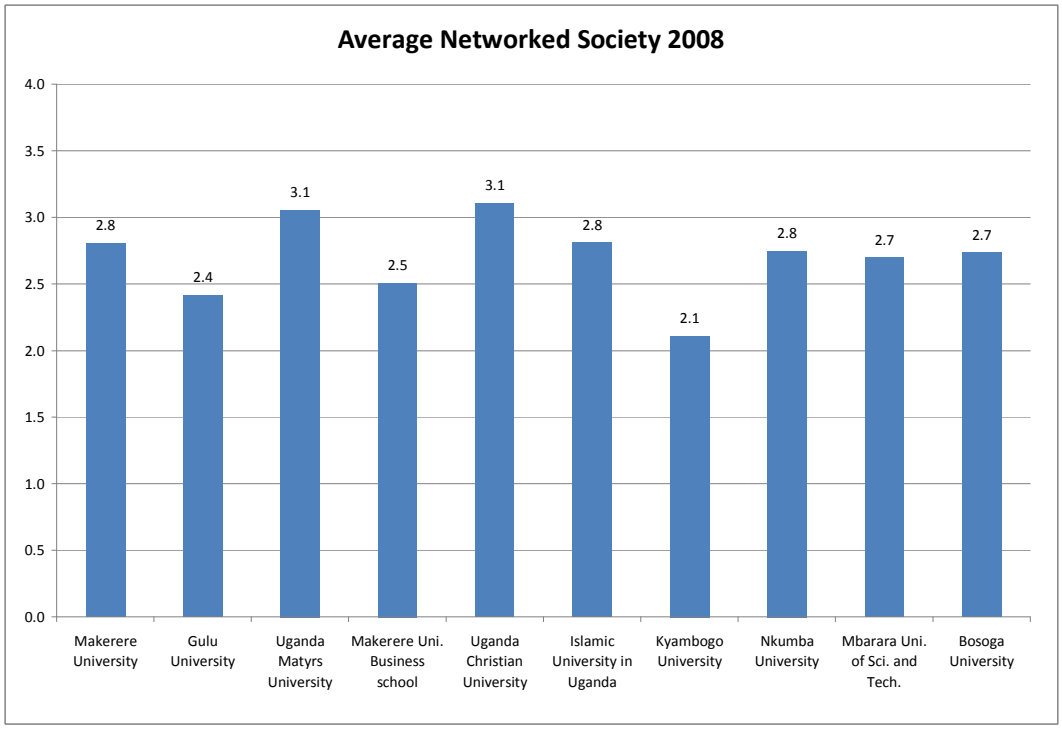


Figure 7.17: Comparing networked society in Ugandan universities

Figure 7.18 shows that universities in Tanzania were not as ready from a networked society perspective as those in Kenya and Uganda. Five universities were between stage 2.5 and 2.6 while four universities were below stage 2.5. The overall staging was 2.4, which means the Tanzanian universities need to get their communities to use ICT for learning and in the workplace for academic work and management as their other counterparts.

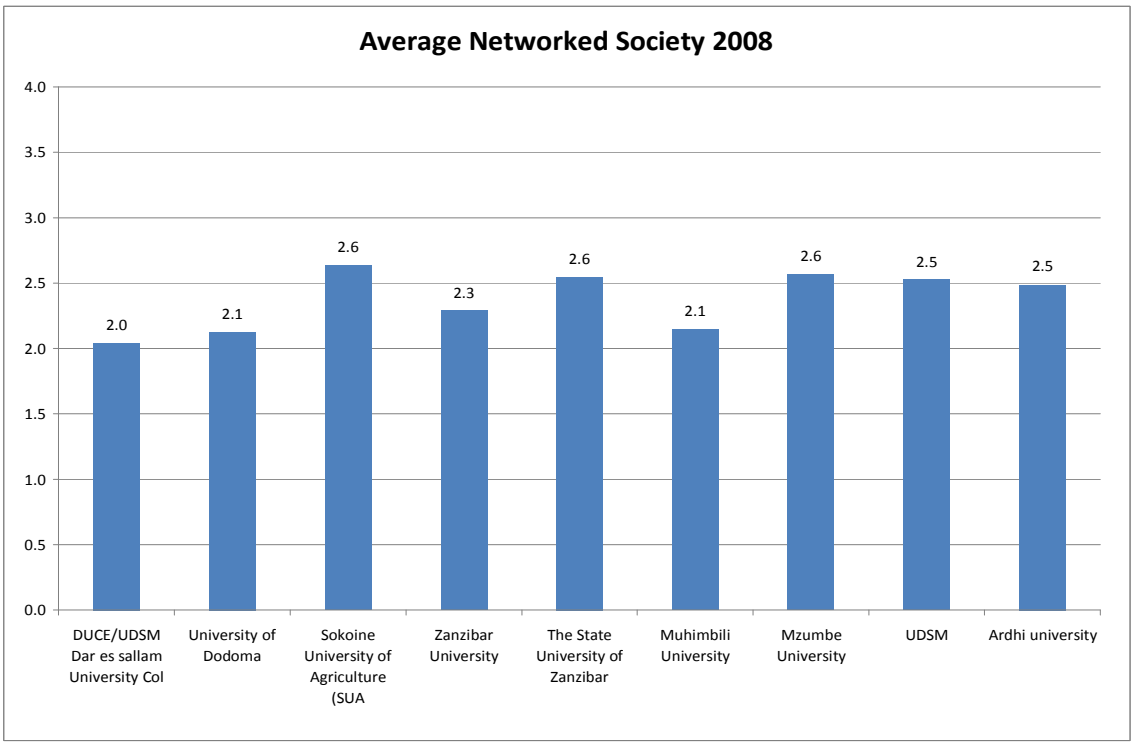


Figure 7.18: Comparing networked society in Tanzanian universities

As shown in Figure 7.19, most universities in Rwanda were above stage 2.5 except the Kigali Institute of Education (KIE). The overall staging was 2.7, as in Kenya and Uganda, illustrating that the community was ready to use ICT for learning and in the workplace for academic work and management.

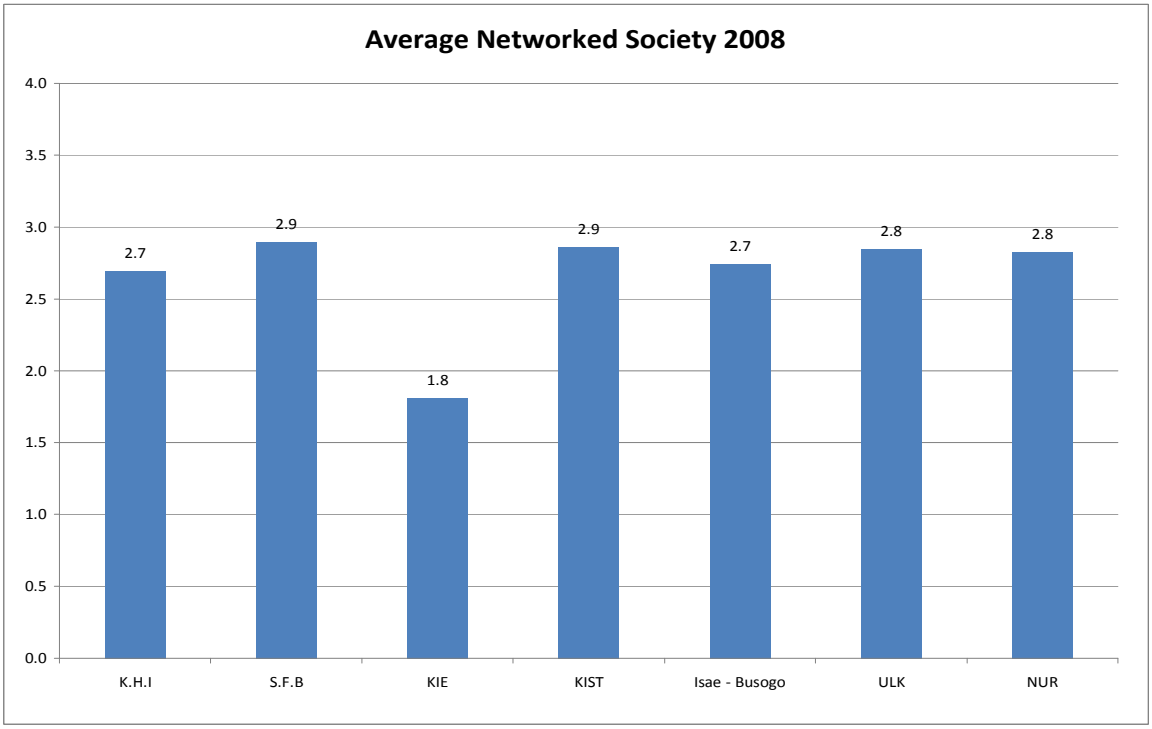


Figure 7.19: Comparing networked society in Rwandan universities

Universities in Burundi were the least ready from a networked society perspective when compared to other universities as shown in Figure 7.20. All universities were at stage 2 and one university, Universite du Lac Tanganyika, was below stage 2. The overall staging was 2.0, which means that universities in Burundi need to do much more to get their communities more ready to use ICT for learning and at the workplace for academic work and management.

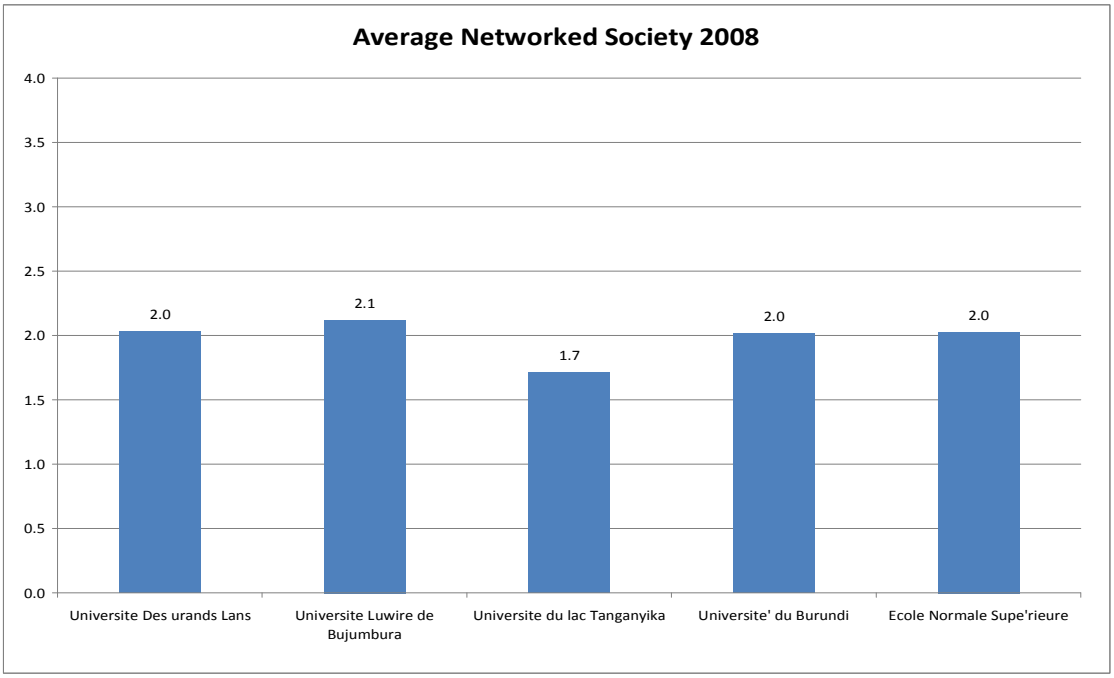


Figure 7.20: Comparing networked society in Burundian universities

7.5 Networked Society average staging by size

This study also analyzed the effect of student enrolment on the networked society indicator category for the 48 universities. Universities were grouped into four categories: small (1000-2,500 students), medium (2,500- 5,000 students), large (5,000 – 15,000) and very large (over 15,000 students). Figure 7.21 shows the results for all categories of universities.

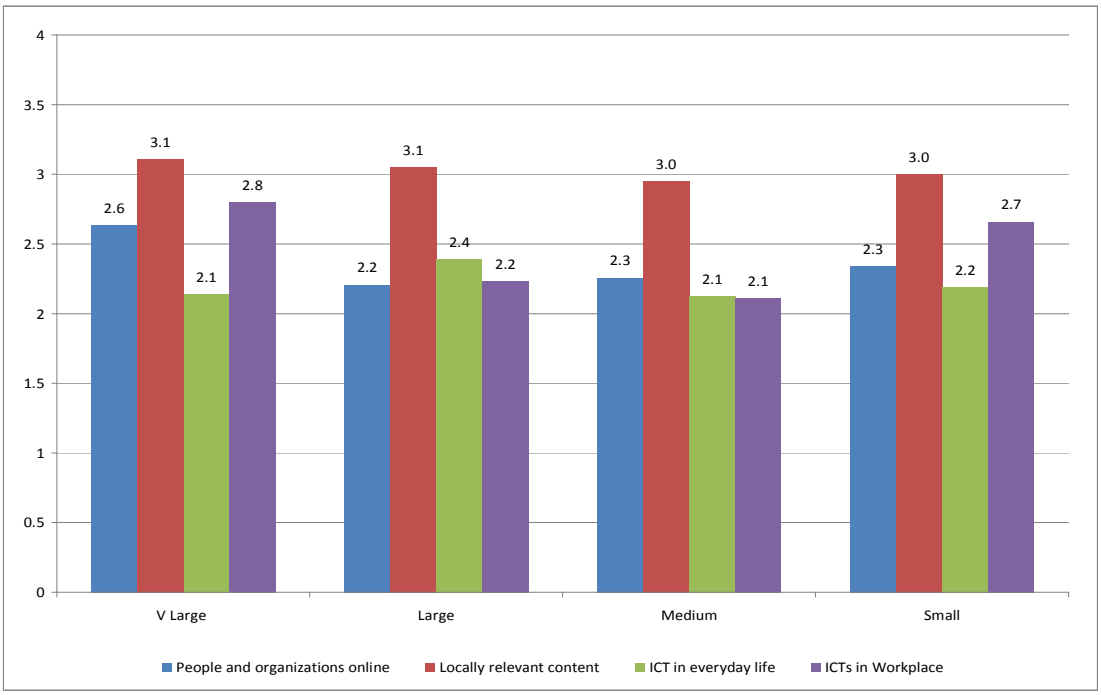


Figure 7.21: Networked staging by category of universities for all EA countries

All categories were at stage 3 for locally relevant content. As argued earlier, this suggested that students and faculty searched for local content for news, entertainment and academic

information. Secondly, almost all categories of universities were similar except for the following differences:

- Very large universities performed best in people and organizations online. They were at stage 2.6 while the other categories were at stage 2.2 and 2.3.
- Small universities performed at almost the same level as very large universities on ICTs in the workplace. This meant that almost 50% of faculty in small universities used e-mail and Internet, just as in very large universities.
- Small universities performed better than medium universities on all indicators. They also performed better than large universities on locally relevant content and ICTs in the workplace indicators.

Overall, the results implied that the readiness of this community was almost independent of the size of the university. This was partly because most of the sub-indicators in the networked category of indicators were determined by the ICT environments of the countries rather than the university campus.

8. INSTITUTIONAL ICT STRATEGY

8.1 Institutional ICT Strategy category of indicators

The Institutional ICT strategy category of indicators comprised the following three indicators:

(i) ICT strategy
(ii) ICT financing
(iii) ICT human capacity

Several sub-indicators were used to measure the ICT strategy including, the alignment of ICT strategy to the corporate strategy, the extent of ICT strategy implementation, and the reporting levels of the head of ICT. *ICT financing* was measured using the sub-indicator of percentage of annual institutional expenditure used to purchase Internet bandwidth. Although a sub-indicator that measured the percentage of budget allocated to ICT was specified as described in Chapter 2, most institutions could not provide the required data to calculate the percentage. The ICT human capacity indicator was measured using several sub-indicators that included the business and technical experience of the head of ICT, frequency in upgrading ICT staff skills, and retention of ICT staff.

Data for staging the three indicators was obtained from the hard facts questionnaires. Figure 8.1 shows the overall country staging for institutional strategy with Burundi's overall performance being much lower than all other countries. Figure 8.2 on the overall staging for the three indicators for all universities surveyed shows low scores of less than 2.0 in ICT financing. The universities however did very well on ICT human capacity, with all countries at 3.0 except for Rwanda and Burundi. Despite the widespread perception that Rwanda had a good national ICT strategy, the performance of its universities in ICT strategy was poor. Kenya performed well and this could be attributed to the awareness created by KENET amongst its members of ICT as a strategic resource and the need to use indicators.

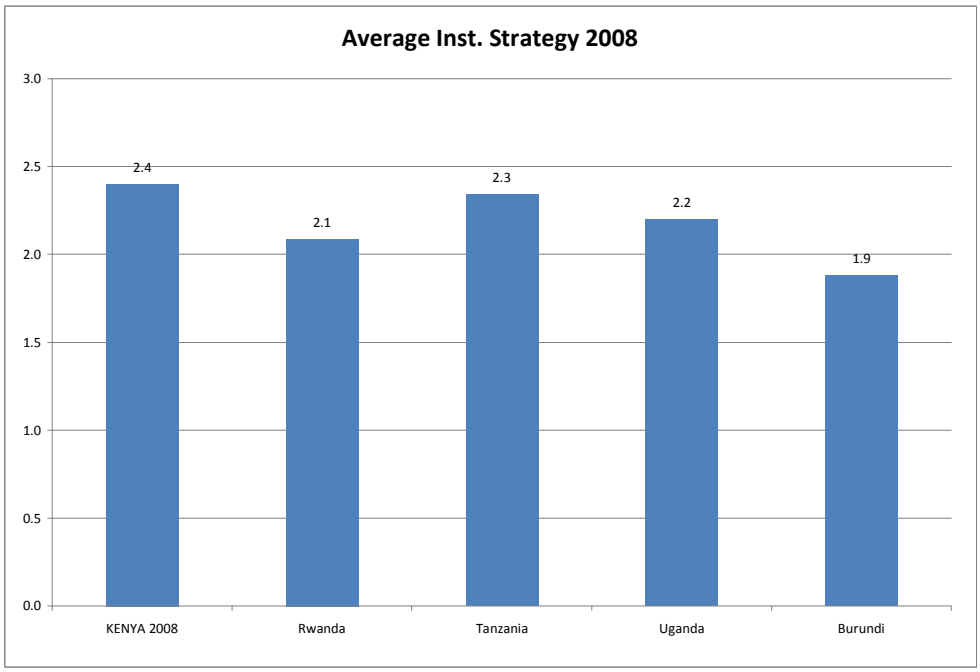


Figure 8.1: Overall country staging of the institutional strategy

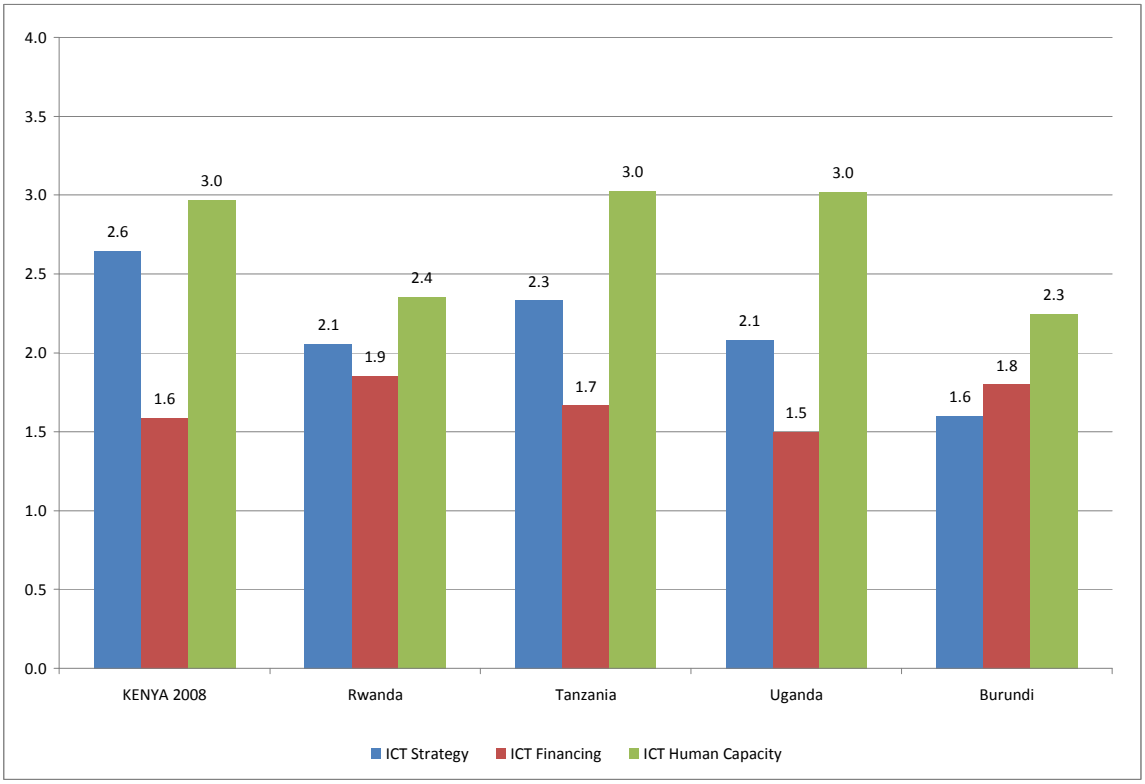


Figure 8.2: Staging of the institutional strategy individual indicators

8.1.1 ICT strategy

The overall staging for ICT strategy was 2.1 for all universities, with all countries scoring above 2.0 except for Burundi. The low average score suggests that most of institutions had not developed detailed ICT strategic plans and the extent of implementation of their strategies was low. For example, only a third of the institutions had a 75-100% alignment of their ICT strategies to their corporate strategic plans as shown in Figure 8.3. The percentage of institutions that reported that at least 50% of their ICT strategies were aligned to the corporate plans was 67% or two-thirds. This means that many ICT projects and activities did not support the core mission of the universities, for example, improved learning outcomes of the graduates or management efficiency.

This study however did not analyze the institutional ICT and corporate strategic plans but used assessment by ICT directors in respective universities. It is possible that a higher percentage of ICT strategies may be out of alignment with corporate strategies than was reported by the heads of ICT who completed the questionnaires. This is a critical issue that requires further detailed study by the universities during the second phase of the accession project.

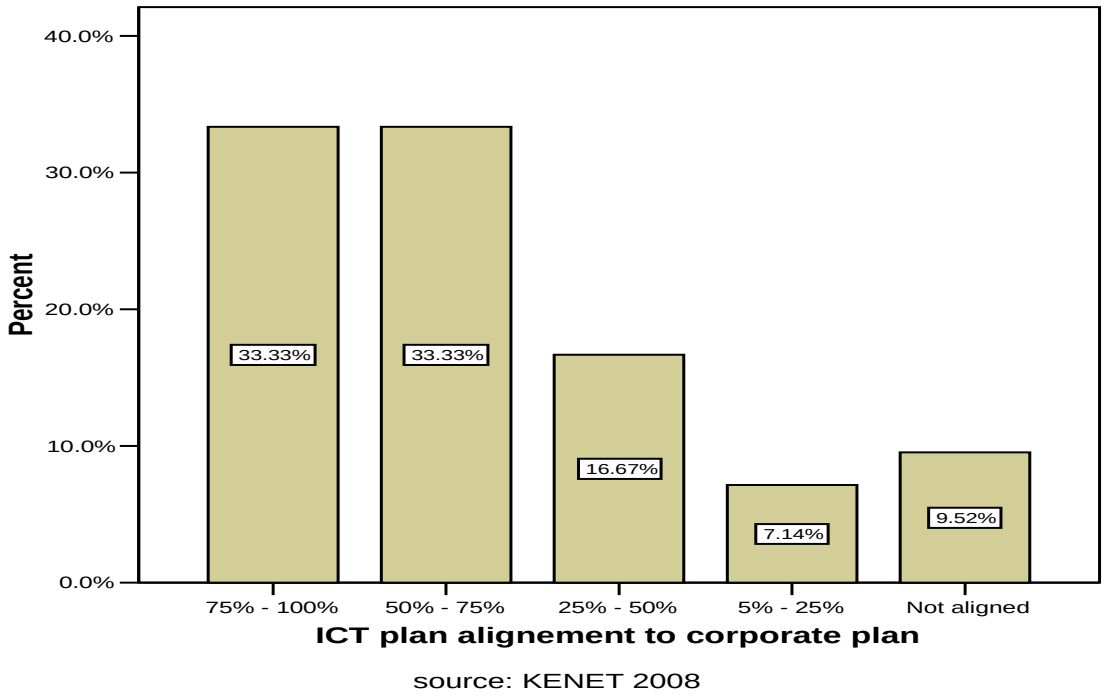


Figure 8.3: Alignment of ICT strategy to corporate strategic plans

One of the strategic sub-indicators was the extent of ICT strategy implementation. The results show that on average the universities were below stage 2. Kenyan institutions improved slightly from stage 1.9 in 2006 to stage 2.1 in 2008 on this sub-indicator. Ugandan universities were at stage 1.5, Tanzania and Rwanda at stage 1.4 and Burundi at stage 1.0. On average all the institutions had implemented less than 50% of their ICT strategies, according to this methodological framework. This represents a major challenge to ICT's strategic role in these institutions.

8.1.2 ICT financing

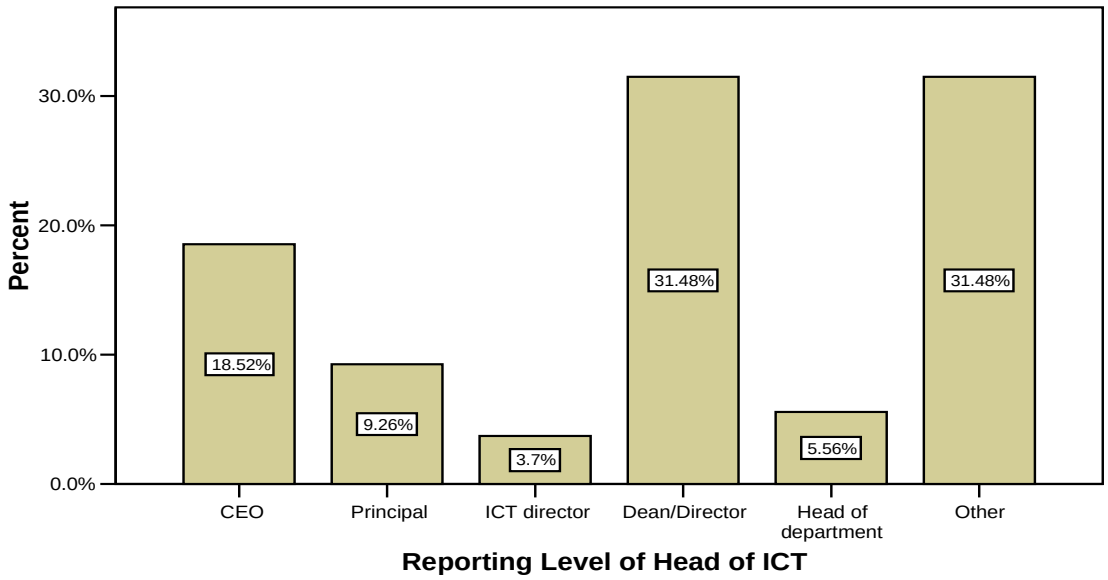
This indicator, scored at stage 1.7 for all the universities, was below average performance. According to this framework, institutions were spending less than 1% (perhaps about 0.5%) of their total budgets on Internet bandwidth.

Satellite Internet bandwidth in East Africa was expensive in 2008 at an average of US$ 3,000 per Mb/s per month for Kenyan universities. This meant that universities should spend more than 1% of budget on Internet budgets. For example, universities at stage 3 and above provided more than 2.5 Mb/s per 1000 students.

For this indicator, Internet bandwidth expenditure was used as a percentage of the institutional budget as a proxy for ICT budget as a percentage of total institutional expenditure. The latter was not used because of the difficulty in getting ICT budgets from the institutions. Universities should be more open with access to their data for research purposes as they should be promoting research and the results of the research would assist them.

8.1.3 ICT human capacity

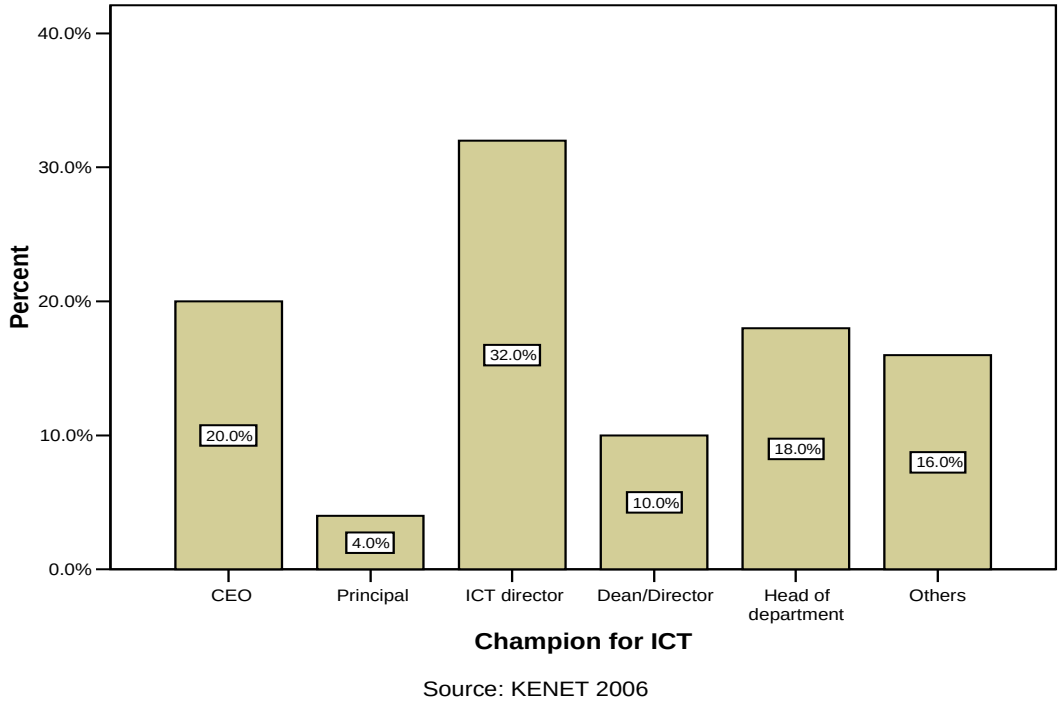
Figure 8.4 shows that heads of ICT reported directly to the Vice Chancellors or deputy Vice Chancellors in 18.5% of the institutions. In over half the institutions, the head of ICT reported to a Dean/Director or lower level. This meant that the strategic profile of ICT was still low in most the universities.



Source: KENET 2008

Figure 8.4: Reporting level of Head of ICT

About 20% of the universities reported that ICT was a section in a department. This meant that ICT was either a department or higher. However, only 20% of the institutions reported that the champion for the ICT strategy was the chief executive officer (CEO) as Figure 8.5 shows. This meant that most ICT departments or divisions reported to lower levels than the CEO. In general, information systems literature has shown that the reporting level of ICT (and the championship of ICT) is associated with higher impacts of ICTs in organizations. In institutions where the head of ICT reports to the CEO; and where the CEO or senior management is the ICT champion, ICT will tend to play a more prominent role in those organizations. This is because ICT is treated as a strategic resource and is managed very closely and effectively. Examples in this study include University of Nairobi and United States International University in Kenya (see Figure 8.6).



Source: KENET 2006

Figure 8.5: Champion of ICT in the institutions

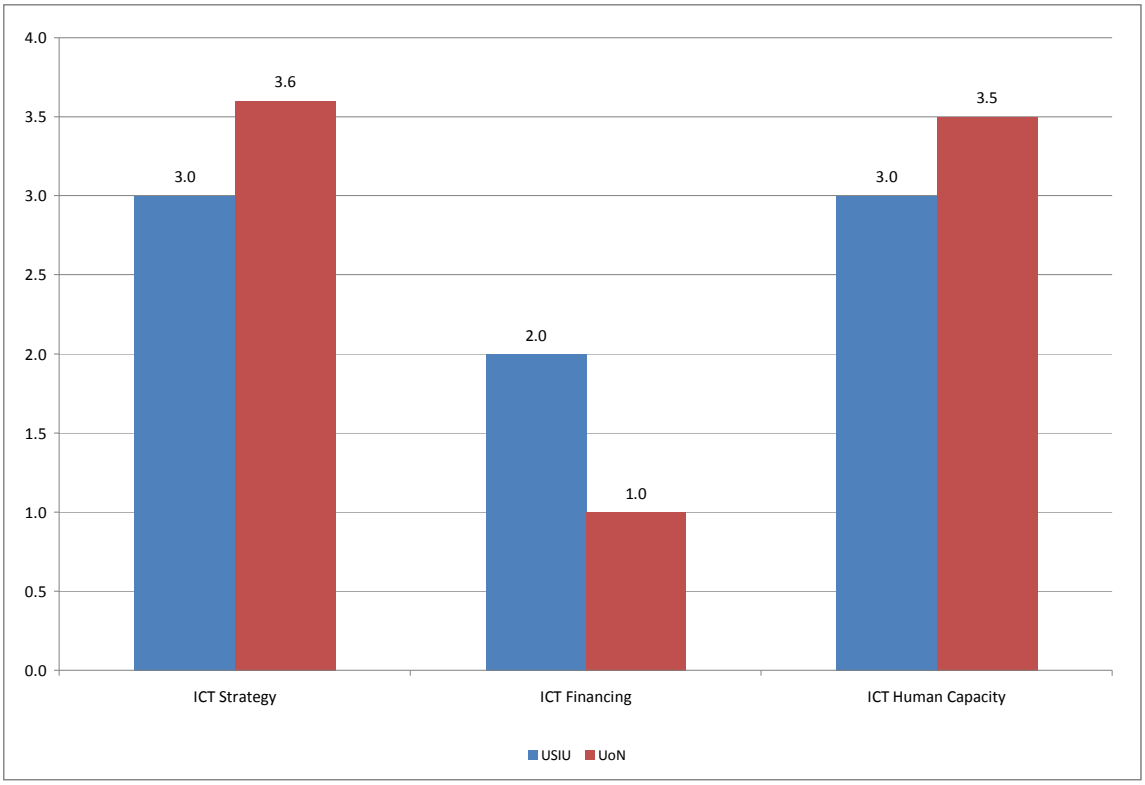


Figure 8.6: Institutional strategy staging for University of Nairobi and USIU

The overall stage for ICT human capacity was 2.7 for all institutions in all countries, with all countries at stage 3.0 except Burundi. This above average score means that most institutions had

made considerable effort in developing ICT capacity. In particular, most universities scored fairly well (about 3.0) in the sub-indicators of the highest qualification of the head of ICT, the administrative experience of the head of ICT and frequency of upgrade of the skills of ICT staff. Overall, Kenya had improved slightly on this indicator from a score of 2.5 in 2006 to a score of 3.0 in 2008.

One strategic sub-indicator was the percentage of professional ICT staff members who had worked for more than three years with users. If this is assumed as a measure of retention, results showed that on average all institutions were at stage 2.4. Kenya improved from stage 2.5 in 2006 to stage 2.7, Uganda was at stage 2.7, Tanzania and Rwanda were at stage 2.4, while Burundi was at stage 1.8. This indicates that institutions on average retained slightly over 25% of their professional staff over a three year period.

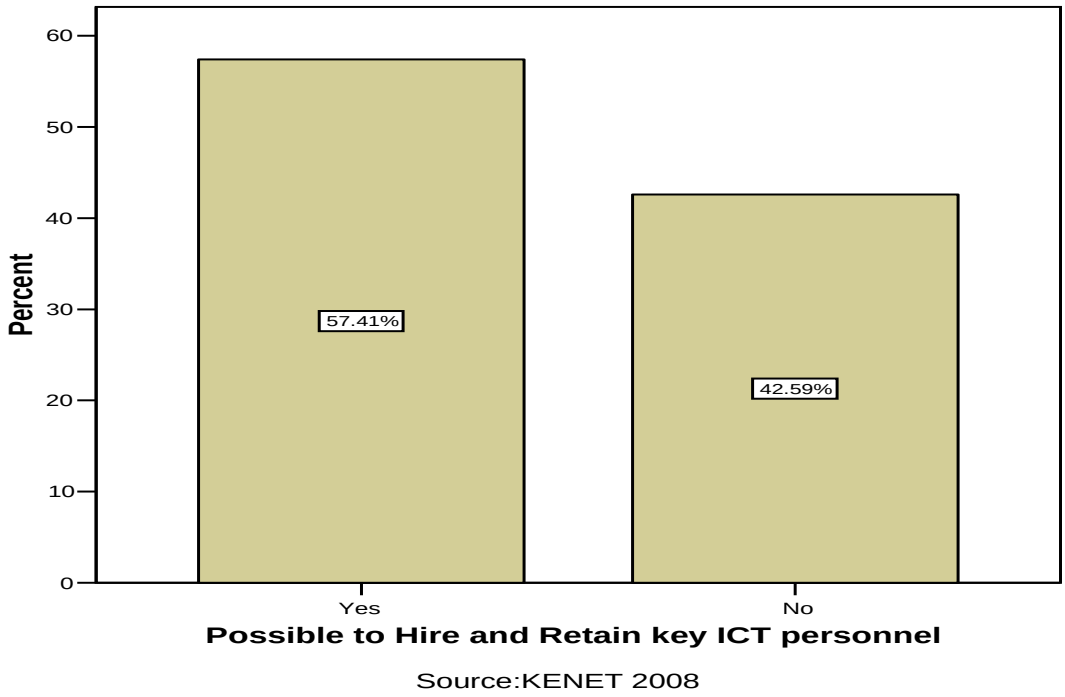


Figure 8.7: Possible to hire and retain key ICT personnel

This is corroborated by Figure 8.7 which shows that 42.6% of the ICT directors thought it was not possible to hire and retain key ICT staff. This indicated that most institutions had difficulty retaining their professional ICT staff. The finding was in line with realities in the region where qualified ICT staff was in great demand. This is a serious challenge to universities striving to sustain their ICT infrastructure and resources. Universities therefore need to create mechanisms for retaining professional ICT staff.

8.2 Overall Staging of Institutional ICT Strategy for individual universities

8.2.1 Institutional ICT strategy average stages of Kenyan universities

From Figure 8.8, Kenya universities had improved on institutional strategy from 2006 to 2008. The greatest improvement was in ICT strategy and ICT human capacity. Kenya had dropped slightly from stage 1.7 to stage 1.6 on ICT financing. The best performance was in ICT human capacity, with an overall stage of 3.0 meaning that on average the universities the head of ICT had a Master's degree and several years of administrative experience, majority of professional staff had worked with users for more than three years and their skills were upgraded every two to three years.

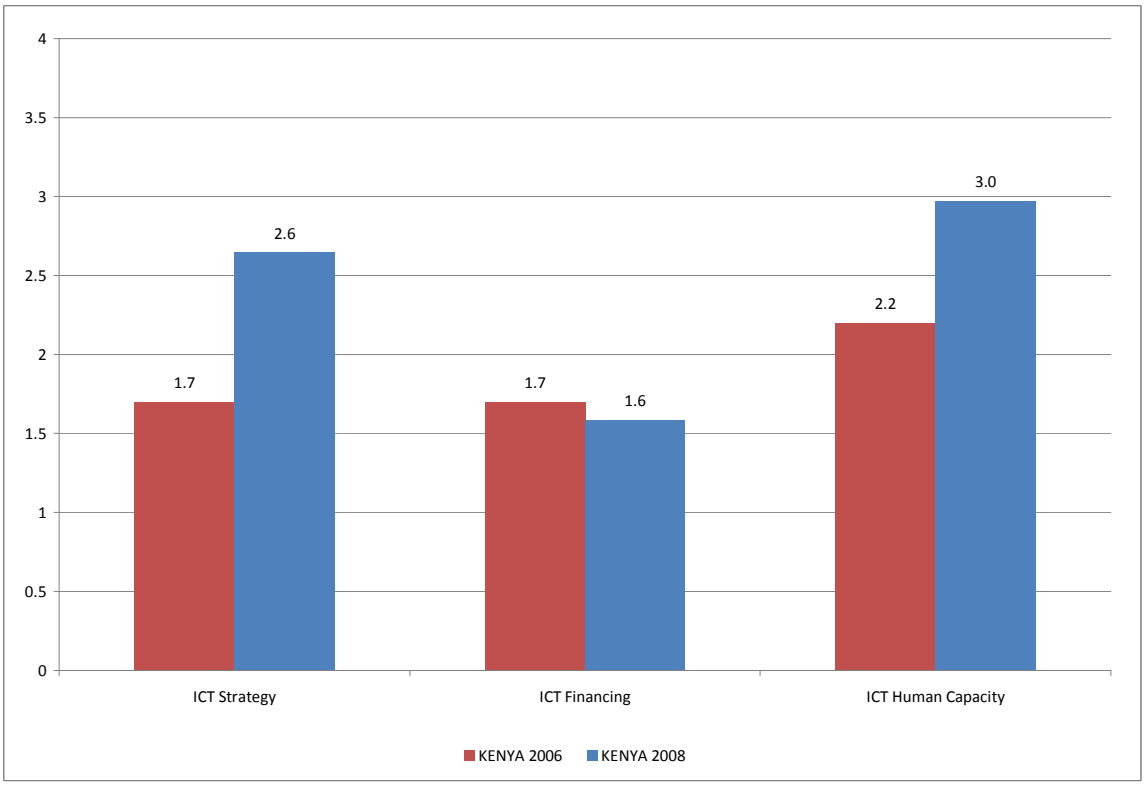


Figure 8.8: Average institutional strategy for 2006 and 2008

ICT financing, which is really Internet bandwidth costs as percentage of the total institutional expenditure, had dropped from stage 1.7 in 2006 to 1.6 in 2008. This may be an indication that Kenyan universities had on average reduced their funding for Internet bandwidth or that the prices of bandwidth had dropped slightly and universities were spending less for the same bandwidth. Another possible explanation could be that universities had expanded and therefore increased their expenditure but their Internet expenditure had not grown at the same rate. The total enrollment for the 17 universities increased from 141,832 to 162,319, a 14.4% increase, though total funding for Internet has not increased by the same margin.

Figure 8.9 shows the average score for institutional strategy for the 17 universities in 2006 and 2008. Most universities had improved on this indicator except for five private universities that had dropped (Catholic, Kabarak, Africa Nazarene, Baraton and USIU) and one public university that has stayed the same (Egerton). Overall, private universities seemed to have a better average

institutional ICT strategy than public universities as the higher scores were from private universities. At the same time, most public universities had improved on institutional ICT strategy over the two years (except Egerton and to a less extent JKUAT).

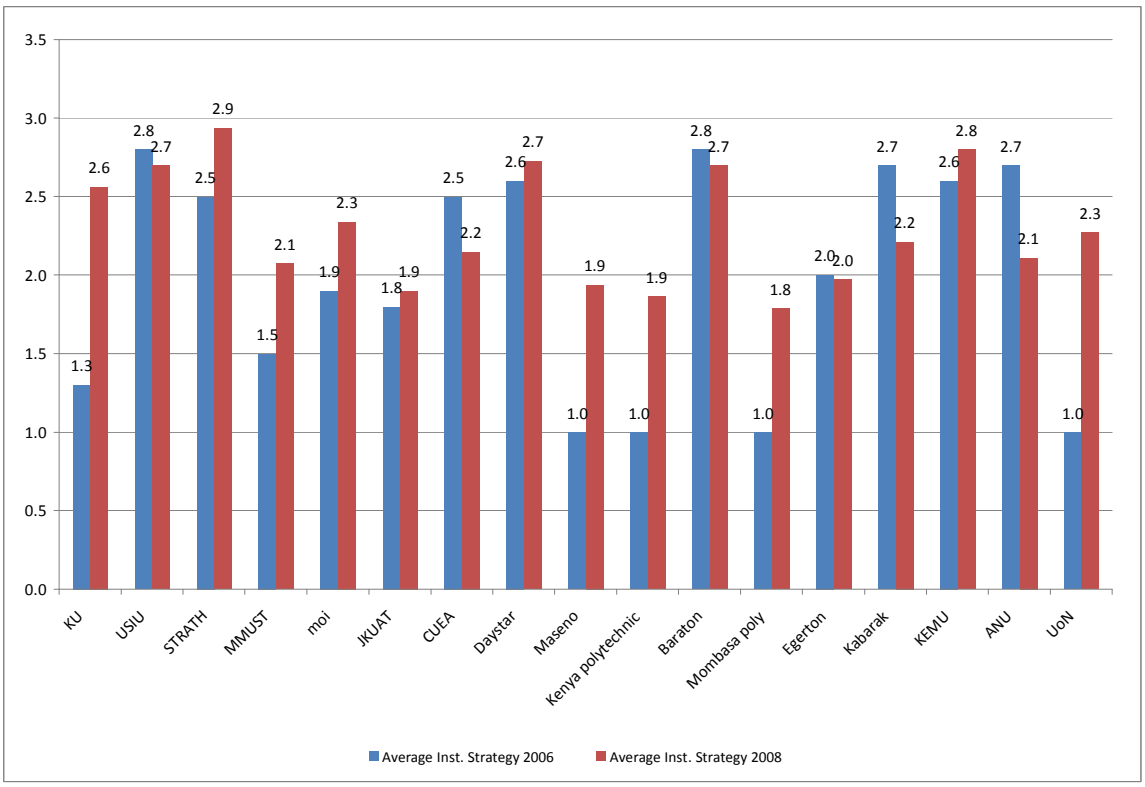


Figure 8.9: Comparing institutional ICT strategy in 2006 and 2008 for Kenyan universities

8.2.2 Institutional strategy average stages of Ugandan universities

As shown in Figure 8.10, most universities in Uganda performed very well on ICT human capacity, with an average score of 3.0. Makerere University attained the highest level of readiness meaning that the head of ICT had a PhD with more than five years administrative experience; over 75% of professional staff had worked with users for more than three years; and ICT staff skills were upgraded every year.

The universities were on average at stage 2.1 in ICT strategy. This meant that ICT was a department with its head reporting to a Dean/Director, that the Dean/Director was the ICT champion and that the alignment of ICT and business strategy and the extent of ICT implementation were below average. Like many other universities in the region, the universities in Uganda were not spending much on Internet bandwidth, and by extension, on ICT.

Most of universities were stage 1 in ICT financing except for the Uganda Christian University, which was at stage 4. This means that this university was spending more than 2% of its annual budget on Internet bandwidth. This was surprising because affordability was at stage 1.0 implying that network access staging was very low, at stage 1.4 and this requires further investigation.

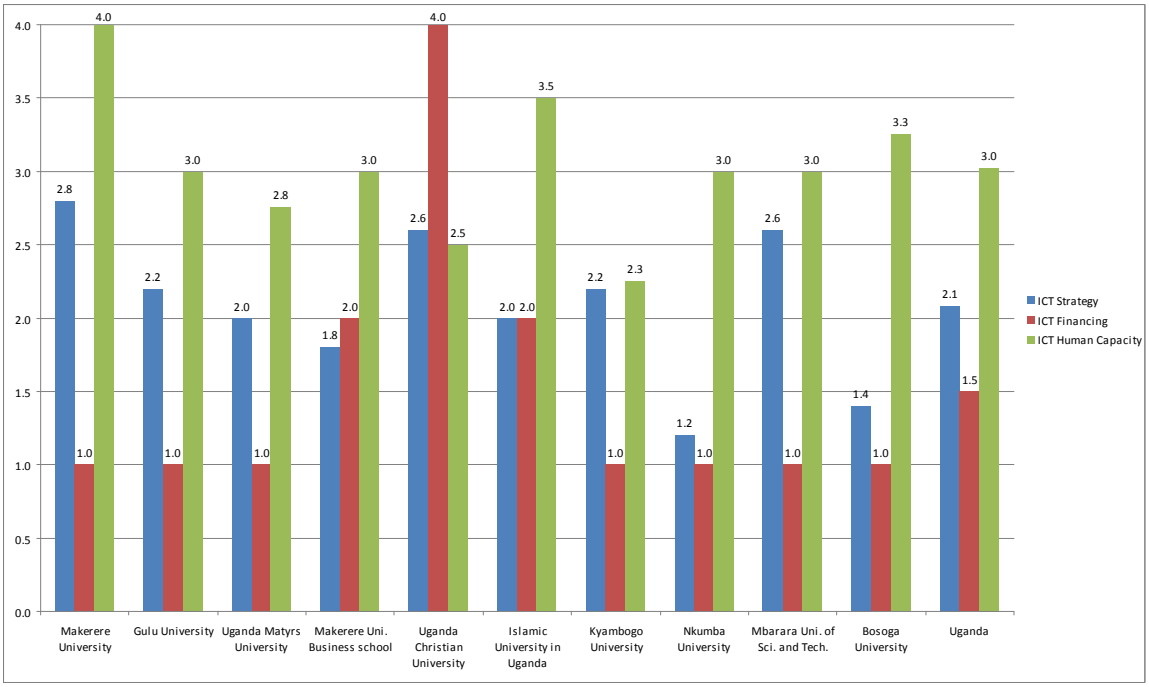


Figure 8.10: Comparing institutional ICT strategy in Ugandan universities

8.2.3 Institutional ICT strategy average stages of Tanzanian universities

As shown in Figure 8.11, most universities in Tanzania performed very well on ICT human capacity, at an average of stage 3.0. The notable universities were University of Dar-es-salaam and Mzumbe University which were between stages 3 and 4.

The universities were at stage of 2.3 in ICT strategy, meaning that ICT was a department with its head reporting to a Dean/Director, that the Dean/Director was the ICT champion and that the alignment of ICT and business strategy and the extent of ICT implementation were below average. The exception was Ardhi University and Muhimbili University, at stages 3.2 and 3.0 respectively. Like many other universities in the region, universities in Tanzania were not spending much on Internet bandwidth, and by extension, on ICT. The average performance on ICT financing was stage 1.7. The only exception was University of Dodoma, which was at the highest level of readiness. This meant that this university was spending more than 2% of its annual budget on Internet bandwidth. This was not surprising because its network access stage was the highest at stage 2.6.

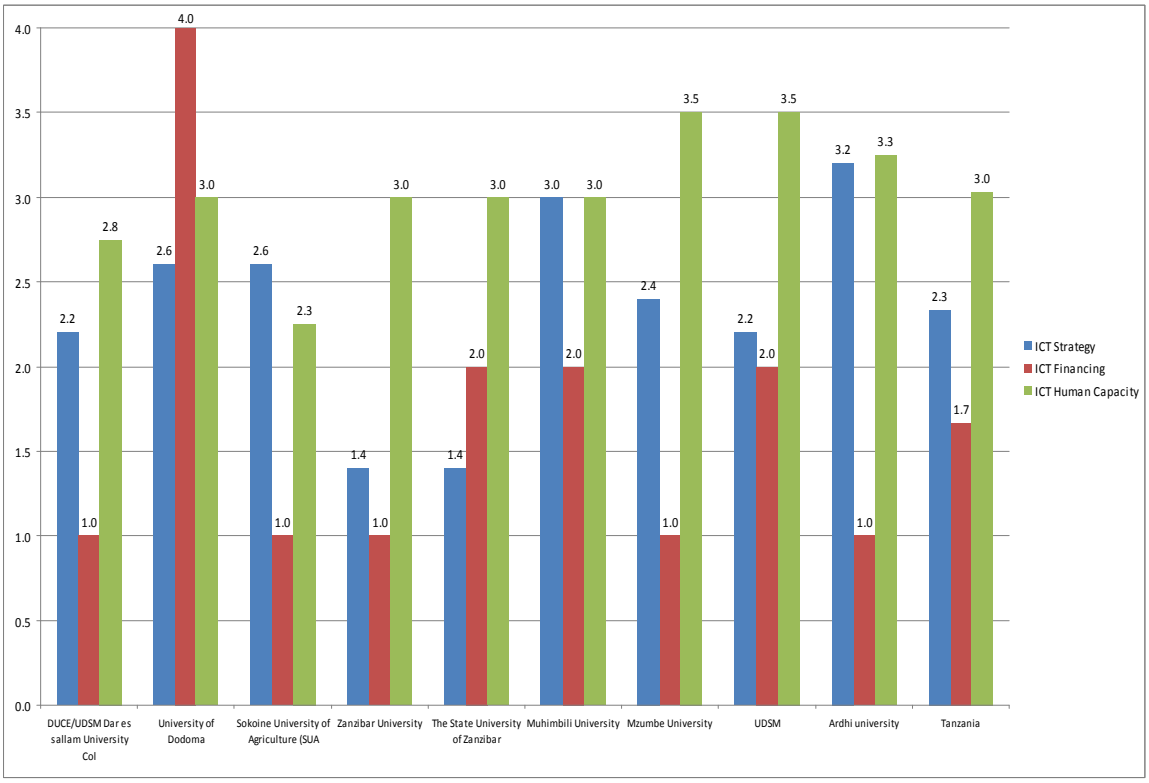


Figure 8.11: Comparing institutional ICT strategy in Tanzanian universities

8.2.4 Institutional ICT strategy average stages of Rwandan universities

As shown in Figure 8.12, on average universities in Rwanda were at stage 2 for both ICT human capacity and ICT strategy. This meant that ICT was a department with its head reporting to a Dean/Director, that the Dean/Director was the ICT champion and that the alignment of ICT and business strategy and the extent of ICT implementation were below average. It was surprising that Rwandan universities did not do well on ICT strategy given the perception that the country had one of the best national ICT strategies in the region.

Although like many other universities in the region, the universities in Rwanda were spending little on Internet bandwidth, and by extension, on ICT, Rwanda's performance was the best on this indicator in the region (stage 1.9). The two exceptions were the Kigali Institute of Education, and the School of Finance and Banking, which were at the highest level of readiness. This meant that these institutions spent over 2% of their annual budget on Internet bandwidth. As in Uganda, this was surprising given that their network access staging was very low, at stage 1.6 and 1.4 respectively. This requires further investigation.

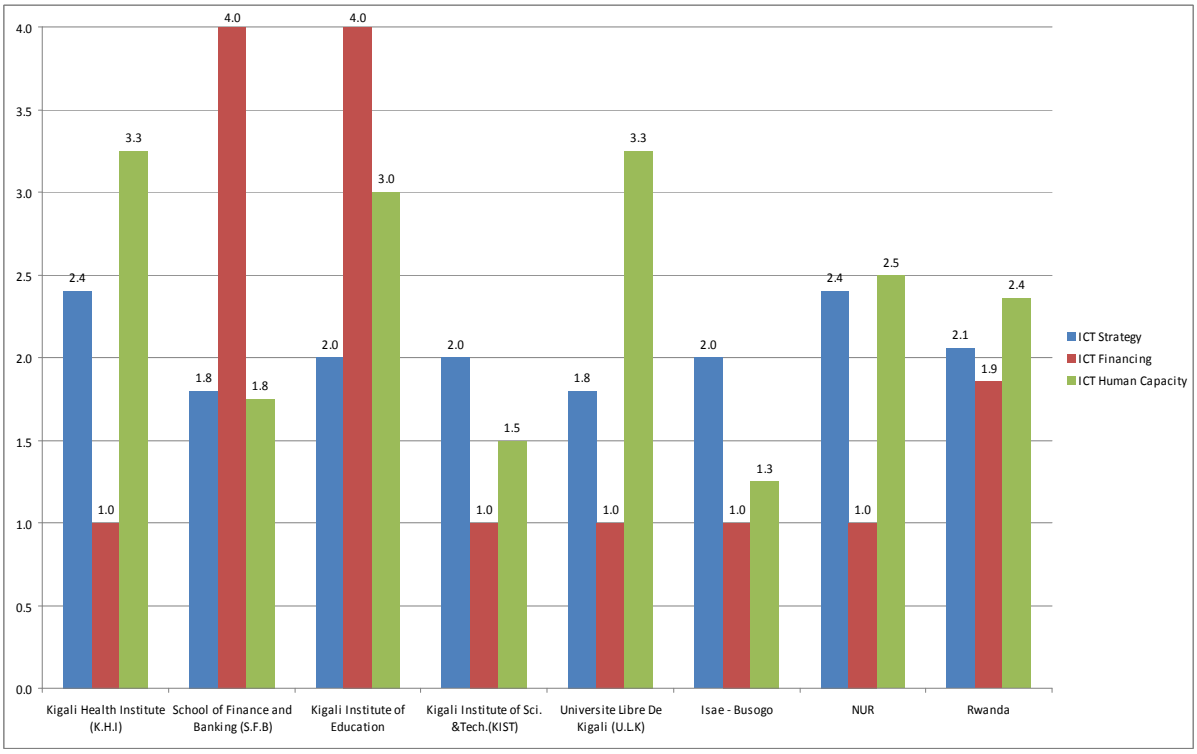


Figure 8.12: Comparing institutional ICT strategy in Rwandan universities

8.2.5 Institutional ICT strategy average stages of Burundian Universities

As shown in Figure 8.13, universities in Burundi were on average at stage 2 for ICT human capacity (stage 2.3) and below stage 2 (stage 1.6) on ICT strategy. For the latter, the universities were on average emerging from stage 1 where the profile of ICT was very low and both the alignment of ICT and business strategy and the extent of ICT implementation were low.

Like many other universities in the region, the universities in Burundi did not spend much on Internet bandwidth, and by extension, on ICT. The average performance on ICT financing was stage 1.8. The only exception was the largest university, Universite du Burundi, which was at the highest level of readiness. This meant that this university was spending over 2% of its annual budget on Internet bandwidth. This was surprising because its network access staging was very low, at stage 1.3. This requires further investigation.

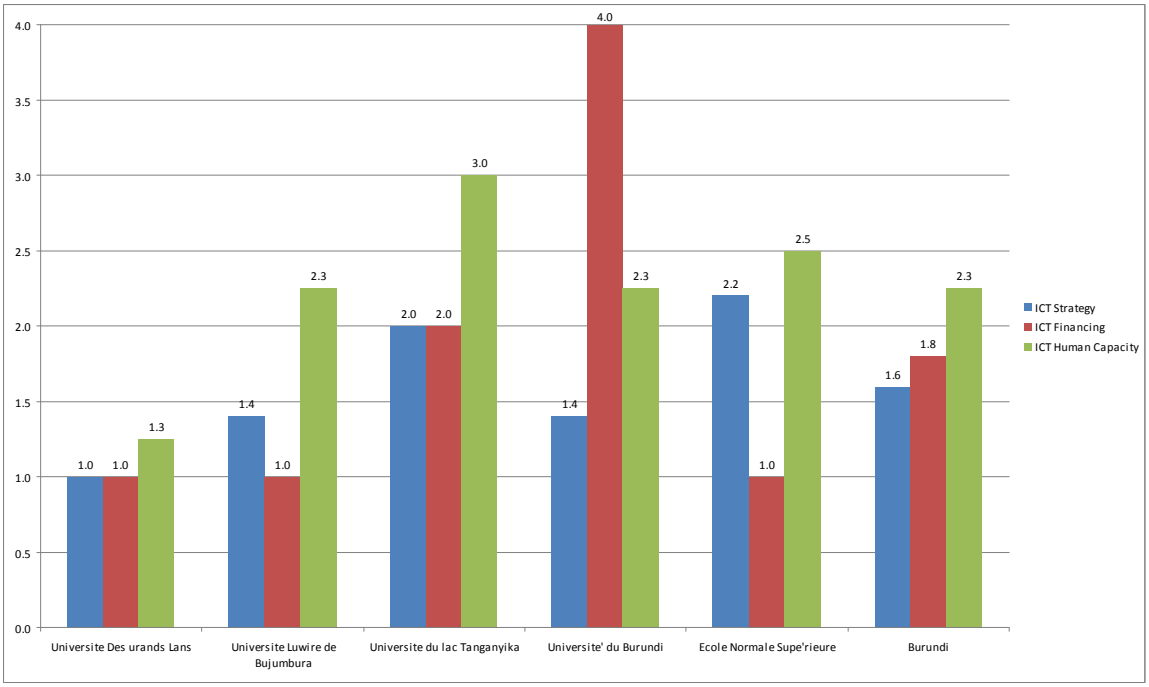


Figure 8.13: Comparing institutional ICT strategy in Burundian universities

8.3 Institutional ICT strategy average staging by size

This study also analyzed the effect of student enrolment on the institutional ICT strategy indicator category for the 48 EA universities. Universities were grouped into small (1000–2,500 students), medium (2,500–5,000 students), large (5,000–15,000) and very large (over 15,000 students) as explained in Chapter 2. Figure 8.14 shows the results for all categories of institutions.

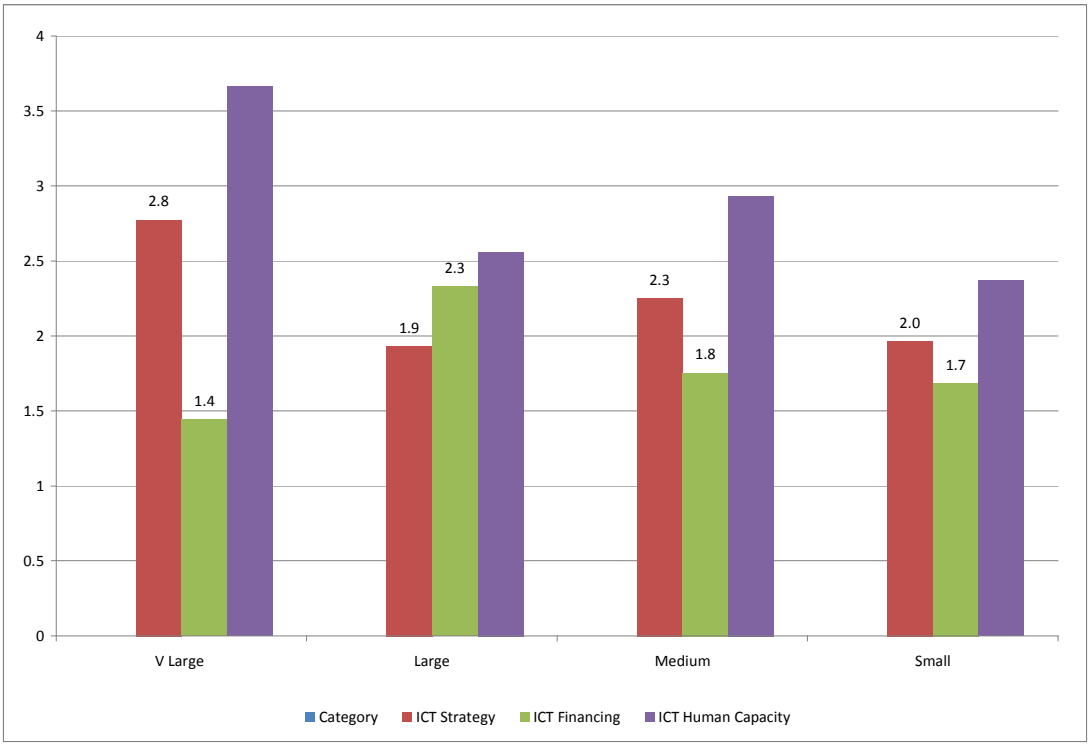


Figure 8.14: Institutional ICT strategy by category of universities for all EA countries

The very large institutions performed very well on ICT human capacity but performed the worst in ICT financing (stage 1.4) across all categories (see Figure 8.15). The very large institutions did much better at ICT human capacity and ICT strategy than all other categories (except for Kenya where the medium sized universities did fairly well on ICT strategy) as shown in Figure 8.15. The good performance on ICT strategy and ICT human capacity by very large institutions was expected as these were the oldest and most established universities in the region. These institutions are however did not spend proportionately on Internet bandwidth, and by extension, on ICT.

The performance of small institutions was on average poor compared to all categories, except in Tanzania where small universities were doing better than the medium category in ICT financing and ICT human capacity. On average, small size institutions were at stage 2 in almost all indicators except ICT human capacity, which was slightly higher (Burundi, Kenya and Tanzania at stage 2.0, 2.5 and 3.1 respectively). At an average of stage 2 of the institutional ICT strategy category meant that the ICT function in small institutions had a very low profile (e.g. in terms of its stature and reporting level), Internet access budgets were a very small proportion of institutional budgets and that ICT professional staff had low academic and technical qualifications and were retained for relatively shorter periods. These institutions have to make a fundamental shift to make ICT a strategic resource, by raising its profile, allocating adequate resources for it and employing staff with the appropriate mix of skills and experience.

An interesting phenomenon was observed in comparing medium size institutions with large size institutions. In Kenya, the medium size institutions performed better than large institutions on all indicators while in Uganda they beat the large institutions in ICT human capacity (see Figure 8.15). On average medium size institutions performed better than large size institutions on both ICT strategy and ICT human capacity (see Figure 8.14), which was surprising as large institutions were expected to at least be good in strategy at their stage of growth. This implies that large size institutions are facing a challenge.

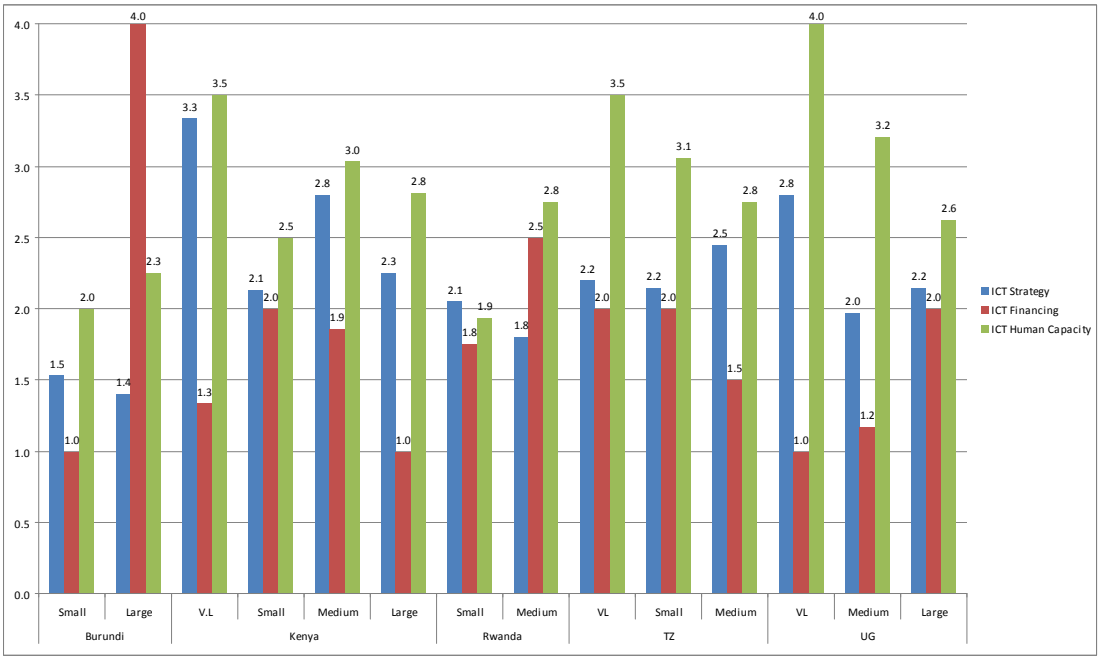


Figure 8.15: Institutional ICT strategy staging by category of universities and by countries

PART 3: SUMMARY FINDINGS AND GENERIC ROADMAPS

9 SUMMARY OF FINDINGS, STRATEGIC SUB-INDICATORS AND CONCLUSIONS

9.1 Survey methodology, data collection and data analysis

9.1.1 Survey methodology

The e-readiness assessment of 50 East African universities was conducted using hard facts and perceptions questionnaires originally developed for the 2006 e-readiness survey of Kenyan higher education institutions [Kashorda, 2007]. The questionnaires were derived from an assessment tool and framework described in detail in Chapter 2 of this report. The assessment tool was motivated by the tool for networked readiness assessment for developing countries originally developed by the Center for International Development (CID) at Harvard University. The tool, which was specifically developed for developing countries, stages 19 indicators grouped into five categories: network access; networked learning; networked society; networked economy; and network policy. Staging involved a combination of hard facts and subjective assessment on a scale of 1 to 4, where 1 meant not ready, while 4 meant fully prepared to participate in the networked world. It later became the starting point for the widely used Networked Readiness Index (NRI), published annually by the World Economic Forum (http://www.weforum.org) and INSEAD business school, for both developing and developed countries.

The survey modified the CID tool by eliminating indicators that were not relevant and replaced them with quantitatively measurable sub-indicators that could be staged on the same scale of 1 to 4. The modified tool contained 17 indicators grouped into five categories: network access, networked campus, networked learning, networked society, and institutional ICT strategy. The framework contained over 60 sub-indicators used to derive the staging for each of the 17 indicators. For example, one of the strategic sub-indicators defined was the number of networked computers per 100 students. The survey defined stage 1 as less than 5 PCs per 100 students, and stage 4, as at least 50 PCs per 100 students. The stages therefore represented a value judgment based on the ICT environment of universities in East Africa; the 2006 survey results; and trends in universities in middle-income countries. These criteria were set as minimalist standards for increasing the ICT readiness and usage in universities.

9.1.2 Data collection

The East African Accession Project aimed to conduct an e-readiness survey of 50 universities in five East African countries of Burundi, Kenya, Rwanda, Tanzania, and Uganda. The survey used a combination of hard facts questionnaires completed by the heads of ICT and a perceptions questionnaire to survey a representative sample of students, faculty, and administrative staff in each university. Sample sizes chosen were statistically significant for each institution.

The lead researchers in Kenya collaborated with the National Research and Education Network (NREN) secretariats in each of the countries, except in Burundi where the NREN had not yet

been created. Associate Researchers from each of the four countries were therefore identified through the NRENs and became part of the project. Burundi was to be covered by Rwanda, although a contact associate researcher was later identified.

Initially 68 universities from all over East Africa applied to participate in the survey as shown in Table 3.1 in Chapter 1. The researchers developed criteria to reduce the number of universities to about 50 by excluding universities with less than 1000 students as well as open universities that did not have a campus. Other criteria included PC ratio, Internet bandwidth ratio and at least five degree programs, with at least one in ICT or science degree program as described in Chapter 3.

Fifty-three universities were selected as follows: Burundi (5), Kenya (17), Rwanda (8), Tanzania (12) and Uganda (11). However, only 48 universities were included in the data analysis. The survey included 322,153 students, with over half 162,192 of them from Kenyan universities. The sample sizes were calculated to be statistically significant for each of the 48 universities. This meant that staging analysis was done for each university individually, as well in aggregate form for all the universities.

Data was collected in a distributed fashion using the method developed in the 2006 survey. Associate researchers coordinated data collection in each country. In total, 27,234 perception questionnaires were completed and entered into a web-based data base by students. The web-based database is hosted at the KENET website (http://eready.kenet.or.ke) and can be can be accessed by authorized members of the universities or other analysts.

The data was analyzed using the staging framework developed by the research study [Kashorda and Waema, 2008] that provides a method of calculating the stages for all the sub-indicators.

9.2 Staging results for 50 East African universities

9.2.1 Overall staging of East African universities

This study analyzed the results for each of the five categories of indicators and for each of the 53 universities surveyed. However, only 48 universities were used in the aggregated analysis as explained in Chapter 3. Detailed results for each of institution has not been presented in this report but will be presented to each institution that plans to use the results for ICT strategic planning. A similar approach was used to disseminate the 2006 survey results. Figure 9.1 summarizes the results of this study by presenting the average stage for each of the 17 indicators in a radar diagram. On average, the East African universities were at stage 2.0 and above in 10 out of the 17 indicators. However, they only achieved stage 3.0 in one indicator of locally relevant content and stage 2.5 and above in only four of the 17 indicators. Our analysis suggests that accession would depend more on the institutional ICT strategy category of indicators than on the other categories of indicators. This would therefore be the main focus during the accession phase of this project.

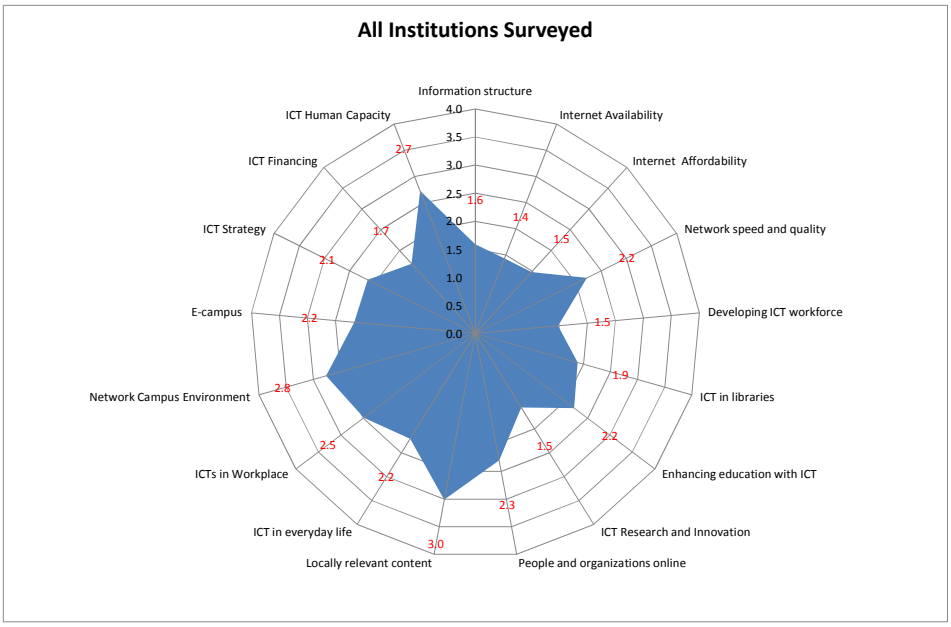


Figure 9.1: Average staging for 17 indicators for EA universities

The following sub-sections, presents the overall staging for each of the other five East African countries included in the survey.

9.2.2 Kenyan universities overall staging

Figure 9.2 shows the comparison of 2006 and 2008 survey results for Kenya (only Kenyan universities were surveyed in 2006). The results show some significant accession to higher stages of readiness in the indicators on ICT in libraries and enhancing education with ICT. However, Kenyan universities recorded only marginal increases in staging for most of the other indicators. The indicators on ICT financing, Internet availability, and developing ICT workforce were still below stage 2.0.

The universities scored low in the developing ICT workforce indicator, which was measured using the sub-indicators that included training of faculty and staff in effective use of ICT applications, the experience of ICT user support staff, and professional certification of ICT professional staff. The low staging means that universities are probably neglecting the training of faculty in effective use of ICT and are probably not retaining experienced ICT technical support staff. This will be an area of focus during the accession phase of this project.

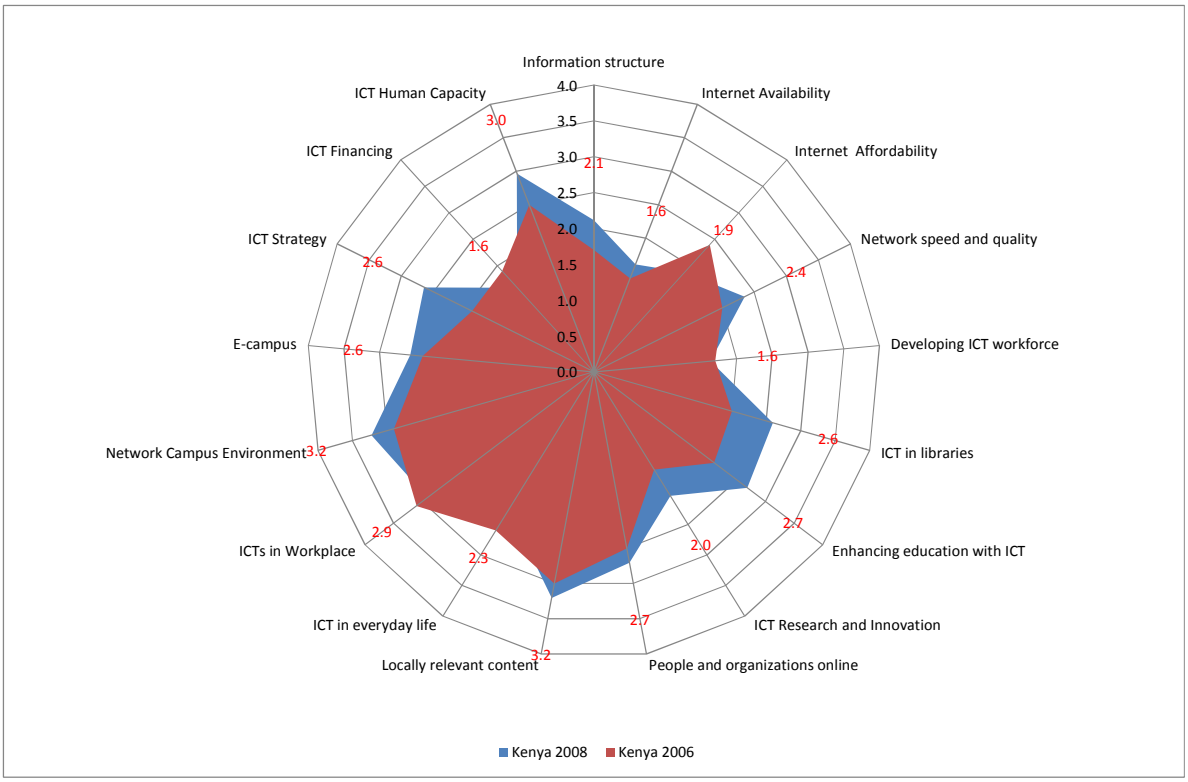


Figure 9.2: 2006 and 2008 survey comparison for Kenyan universities

In general, the results for Kenya suggest that accession to stage 4 is a slow process and could take up to four years to achieve stage 4 for most indicators. Although phase 2 of this study will reveal the factors that influence accession to higher stages, anecdotal data suggests that the universities that responded to the 2006 survey had achieved stage 3.0 and above in most of the 17 indicators in the two years. Moreover, an increase in ICT strategy stage translated into significant changes in networked learning category of indicators as demonstrated. Examples of Kenyan universities that recorded the most dramatic accession in staging included Strathmore University (private) and Kenyatta University (public).

9.2.3 Uganda universities overall staging

Figure 9.3 shows that overall Ugandan universities were at stage 2.5 and above in four indicators, namely, ICT human capacity, networked campus environment, people and organizations online and ICTs at the workplace. However, the universities were below 2.0 in six indicators out of the 17. We particularly note that Internet availability, Information infrastructure, and ICT financing were all at stage 1.5 and below. Thus, Uganda universities will need to focus on these three indicators. For example, Makerere University achieved relatively high staging in most of the indicators but was at stage 1.0 in ICT financing. This suggests that in Makerere University, an increase to stage 2.0 or better in ICT financing could result in most of the other indicators achieving stage 4.0.

One of the weaknesses of the ICT financing indicator used in our assessment framework was that only used Internet bandwidth cost as a proxy to ICT financing. This was due to the fact that it was difficult to collect data on ICT financing (e.g., ERP, e-learning, campus network, and ICT staff salaries costs). It was therefore possible that university with a relatively high ICT budget was

still unable to allocate adequate Internet bandwidth budgets. This will be the focus in the next phase of this study.

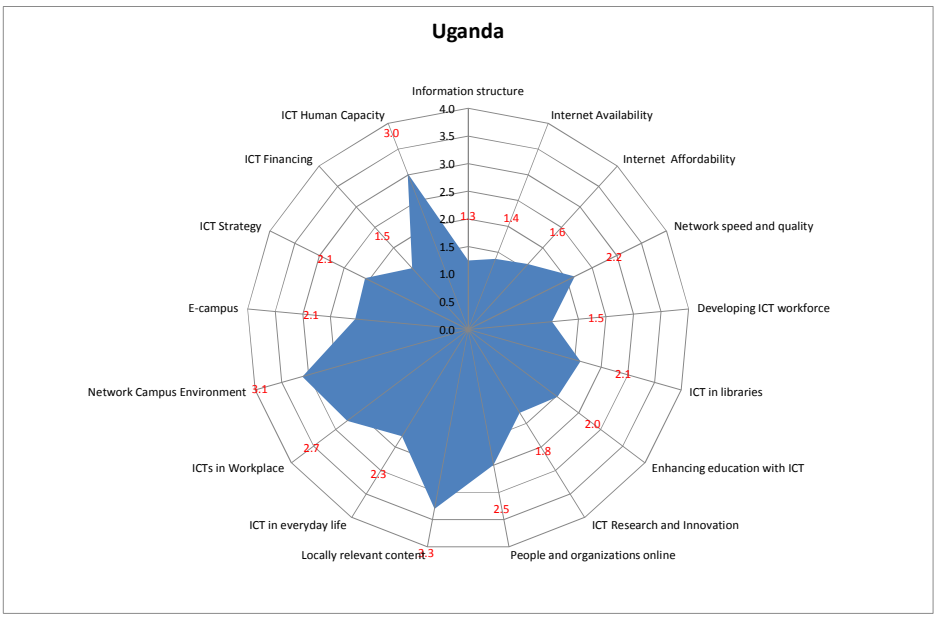


Figure 9.3: Overall staging of Uganda universities

9.2.3 Overall staging of Tanzania Universities

Tanzanian universities were at stage 2.5 and above in four of the 17 indicators (as shown in Figure 9.4), indicating a relatively high state of readiness of networked campus indicators when compared to the network access category of indicators. However, Tanzania universities were in relatively low stages in ICT research and innovation indicator at stage 1.4 as well as ICT in libraries at stage 1.8. This means that most of universities have not automated their libraries and do not provide off-campus OPAC services. This was consistent with the average for the universities in East Africa (Figure 9.1) but lower than the corresponding stages for Kenyan universities.

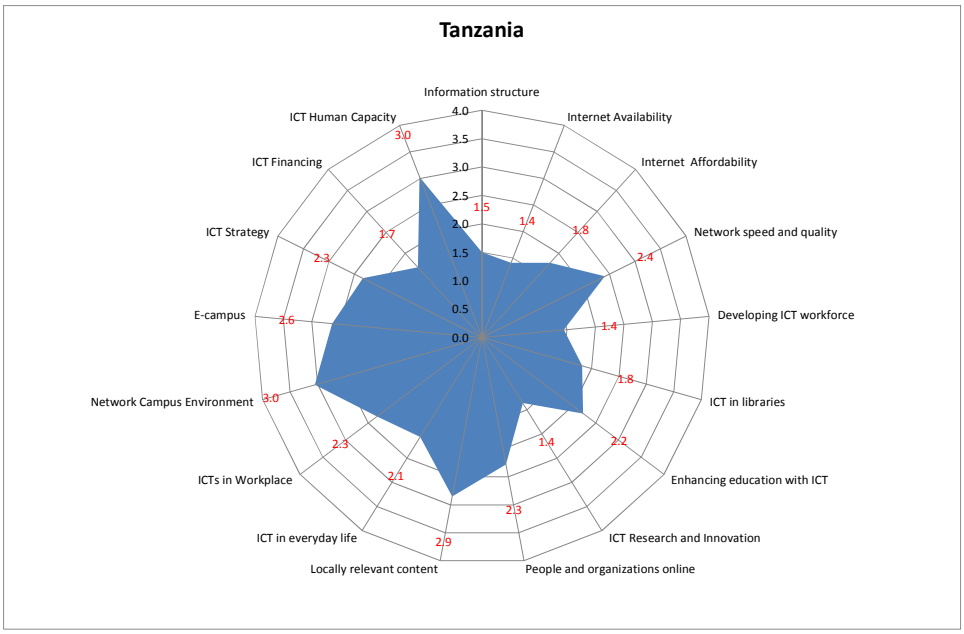


Figure 9.4: Overall staging of Tanzania universities

9.2.4 Staging for Rwanda universities

Rwandan universities were at stage 2.5 and above in three of the 17 indicators and below stage 2 in seven indicators as shown in Figure 9.5. As expected the network access category was all below stage 2.0 except for the perception-based indicator of network quality and speed. Rwanda universities surveyed were at stage 1.7 in ICTs in libraries indicator compared to 2.6 for Kenyan universities. This suggests limited automation of libraries and limited use of ICT in the libraries. Rwanda universities were also at stage 1.4 in developing ICT workforce as well as ICT research and innovation indicator at stage 1.4. High scores in these indicators are achieved by internal strategic decisions and Rwanda should therefore aim to improve its staging in ICT strategy from 2.1 to 3.0 and above.

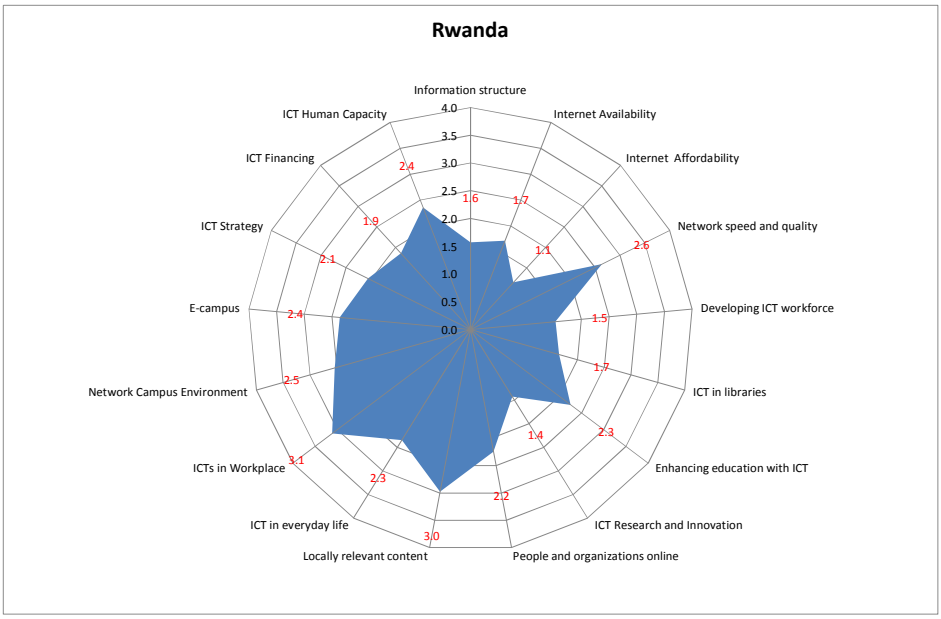


Figure 9.5: Overall staging of Rwanda universities

9.2.5 Burundi Universities overall staging

Burundi universities are in the lowest stage of readiness when compared to other universities in the region. For example, Figure 9.6 shows that the universities did not achieve stage 3.0 in any of the 17 indicators. Only locally relevent indicator was at stage 2.7, but this is not an internal campus indicator because the local content is not necessarily within the universities. The universities achieved a low score in networked campus indicators (i.e., the internal ICT enviroment) as well as the institutional ICT strategy category of indicators. This was also the case for the networked learning category of indicators.

Burudi universities will therefore need special attention to develop the campuses and to automate other operations of the universities. Our analysis suggests that they should start with a focus on the ICT institutional strategy category of indicators.

The following sub-sections present summary results on overall staging for each of the five categories of the e-readiness indicators.

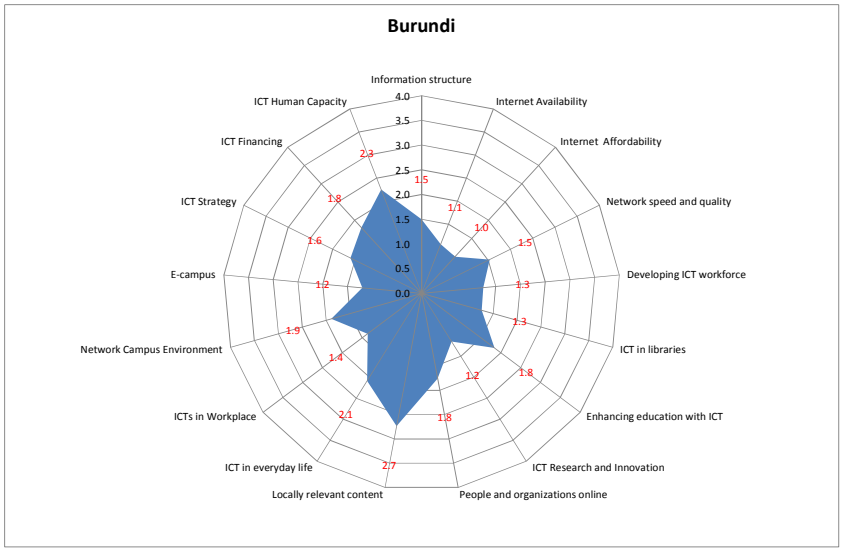


Figure 9.6: Overall staging of Burundi Universities

9.3 Overall staging for different categories of indicators

9.3.1 Network access

The network category consists of four indicators: information infrastructure, Internet availability, Internet affordability, and network speed and quality. On average, the universities were below stage 2 in all except the network speed and quality indicator. The low score in information infrastructure means that university campuses are not providing adequate internal and/or internal voice communication services and have low internal teledensity, which can be improved by well-designed campus infrastructure.

The Internet availability stage of 1.4 suggests that universities are providing less than 512 kb/s per 1000 students of bandwidth and less than 5 PCs per 100 students according to the staging framework. For example, all the 48 universities were purchasing only 152 Mb/s for a total population of about 330,000 students, an overall ratio of only 0.45 Mb/s per 1000 students. Similarly, the PC ratios were all below the ratio of 10 PCs per 100 students recommended in the 2006 survey of Kenyan universities.

The Internet affordability at stage 1.5 means that universities were spending about US$ 13,000 per 1000 students. This represents less than 1% of the annual budgets of the universities. Universities at stage 4 would have to spend over US$ 37,000 per 1000 students at the 2008 average satellite bandwidth prices in East Africa of about US$ 2,100 per Mb/s per month (*see demographic data in Chapter 4*).

Overall network speed and quality was at stage 2.2. Since this was measured using only perception data, it means that universities still need to invest in their campus networks in order to achieve a higher stage in this indicator.

9.3.2 Networked campus

The networked campus category of indicators (network environment and e-campus indicators) is closely related to the network access category. The results in Figure 9.1 show the universities were at stages 2.8 and 2.2 in network environment and e-campus indicators respectively. This means that most of universities were ready to start using ICT to support all their operations. However, at stage 2.2 in e-campus indicator, most of the administrative and financial processes were not automated and the institutional websites were not being updated regularly.

Achieving a high score in this category of indicators depends almost entirely on internal factors rather than external factors such as cost of bandwidth or state of the national information infrastructure. While Kenya, Uganda, Tanzania, and Rwanda were all in stage 2.0 and above in networked campus category of indicators (see Figures 9.3, 9.4, and 9.5), this was not the case for Burundi (see Figure 9.6). It was therefore seems that Burundi might require special focus in this category of indicators.

9.3.3. Networked society

The network society category consists of four indicators: ICT in the workplace, ICT in everyday life, people and organizations online, and locally relevant content. Figure 9.1 shows that the university community (i.e., students, faculty and staff) exhibits relatively high level of readiness at stage 2.0 and above in all indicators. The lowest stage was in ICTs in everyday life at stage 2.2 which is an indicator of the diffusion of ICT outside the university campus as well as low ICT access for students within the campuses. Limited availability of ICTs in universities was driving the community to cyber cafés. For example, about 50% of student respondents considered the cyber café as their primary access to computers and the Internet. This percentage is highest in countries in low stages in the networked campus category of indicators, such as Burundi where 87% of the student respondents considered cyber cafés as their primary access to computers.

The university community in East Africa was also using computers largely for e-mail with up to 72% of the students in Kenya, reporting that they used computers to access e-mail. The use of computers for data analysis was significant (in the range of 10% to about 40% depending on the country), suggesting the use of computers for learning and research. Computers were also used for word processing (about 45% of the student respondents) and for entertainment with about 50% of students in Kenya, Uganda, and Burundi reporting that they used computers and the Internet for entertainment.

Thus, the community was ready to use computers and Internet for research and learning even under the limited ICT access environment where many students had to access computers in cyber cafés.

9.3.4 Networked society and gender

This study conducted a gender analysis of some of the networked society sub-indicators that measure ICT usage and access. These sub-indicators include location of access to computers and Internet, purpose of using computers, frequency of access to websites, and regular visit to local Web portals. The results show that there was no significant difference in ICT usage between

male and female students and faculty. For example, 48.8% of male respondents reported that they used the Internet daily compared to 49.47% of female respondents.

The perception survey also collected data on the use of mobile Internet by male and female students. The results show that about 50% of the male respondents used mobile Internet compared to about 47% of female respondents. The students therefore actively used mobile Internet, mostly from their mobile phones rather than as a modem for their PCs. This suggests that mobile Internet will play a significant role in access to learning resources by students in East African universities and this should be a new area for research.

In terms of regular usage of Internet, male students were marginally more intense users of the Internet. For example, about 32% of female respondents did not visit any local websites compared to about 28% of male respondents who did not visit local websites. In conclusion, there was no significant gender difference in the use of ICTs and specifically the Internet.

9.3.5 Institutional ICT strategy

The Institutional ICT strategy category of indicators consists of three indicators: ICT strategy, ICT financing, and ICT human capacity. All the three indicators were staged using hard facts questionnaires completed by ICT directors with the help of finance officers and senior leadership of the universities.

Overall, Kenyan universities with an aggregate stage 2.4 were marginally at a higher stage than the other universities. However, all universities surveyed were below stage???? in ICT financing, with the average being stage 1.7 as shown in Figure 9.1. This means the universities were spending just about 0.3% of their annual expenditures on Internet bandwidth (Internet bandwidth cost was used as a proxy for ICT financing). The East African universities therefore, on average, have the capacity to increase Internet bandwidth budget to be about 2% of the total expenditure required to achieve stage 4, assuming satellite bandwidth prices of over US$ 2,100 per Mb/s per month.

Kenyan universities were at stage 2.6 in ICT strategy indicator compared to Rwanda at stage 2.1, Tanzania at stage 2.3, Uganda at stage 2.1 and Burundi at stage 1.6. At the average of stage 2.1 in ICT strategy, this means that under 50% of the ICT strategy has been implemented and only 33% of the ICT strategies were aligned to the mission of the universities. Moreover, only about 18% of the heads of ICT were reporting directly to the Vice Chancellors (VCs).

The universities were in relatively higher stage of 2.7 in ICT human capacity indicator suggesting that universities were attracting highly qualified ICT staff and retaining them for two to three years. The heads of ICT had at least a Bachelor's degree in ICT and many had postgraduate qualifications. Thus, universities in East Africa already have the capacity to support large-scale deployment of ICTs in their campuses and only need greater alignment of ICT strategies to their learning outcomes and a significant increase in ICT budgets.

The next section summarizes the findings on the outcomes of all the categories of indicators, namely, networked learning category of indicators.

9.3.6 Networked learning

The four categories of indicators: network access, networked society, networked campus, and institutional ICT strategy; exist predominantly to support the networked learning category of indicators. That is, an increase in the stages of the other four categories of indicators is supposed to translate into an increase in the stages of the networked learning category of indicators.

Networked learning category consists of the following four indicators:

(i) Developing ICT workforce
(ii) ICTs in libraries
(iii) ICT research and innovations
(iv) Enhancing ICT with education.

These indicators therefore measure the use of ICT in learning, research, and teaching. The results in Figure 9.1 show that universities in East Africa were at a low of stage 1.5 in developing ICT workforce. This means that the universities are not training the faculty in common productivity tools or using ICT for training with internal e-learning systems. This affects the adoption of ICT for learning and research by the university community.

The universities were also at stage 1.5 in ICT research and innovations. This means, for example, that although 72% of the universities surveyed offered undergraduate ICT degrees, only 30% of the universities offered ICT degrees at Master's level and only 12% offered PhDs. Moreover, 43% of ICT departments did not participate in national and international ICT exhibitions.

The universities were only at stage 1.9 in ICTs in libraries. This means that most libraries are still not automated and OPAC was not available off-campus. This was despite the fact that most of students did not reside in university campuses and required off-campus access to learning resources. However, a few universities, including USIU and University of Nairobi in Kenya, and Makerere University in Uganda, achieved stage 3 and above in ICT libraries indicator. Such universities had automated all their frontend and backend processes and were also providing off-campus OPAC services.

The enhancing education with ICT indicator was at stage 2.2. This means that only about 50% of the universities had course management systems such as WebCT, Blackboard or Moodle that are used for managing on-line courses. There was also limited use of ICT in the classrooms and a significant number of student projects did not have an ICT component. However, the universities had started acknowledging ICT as a tool for enhancing education and some leading universities had achieved stage 3.0 and above in this indicator. In general, such universities were also the ones where the champion for ICTs was the Vice Chancellor or at least a Deputy Vice Chancellor.

Each of the universities could benefit from a detailed review of their strategic plans using the detailed results generated by this study. This will form part of the second phase of this study for a limited number of universities in East Africa.

9.4 Summary of results by size of universities

This study analyzed the effect of size of the universities as classified as follows: small (1000 – 2,500 students); medium (2,500 – 5,000 students); large (5,000 – 20,000 students); and very large (over 20,000 students).

The small and medium universities tended to be new private universities, while the large and very large universities were the well established public universities. Rwanda and Burundi did not have any universities in the very large category.

The results suggest that the very large universities were most prepared to use ICT on a large scale in teaching, learning, and research despite being at low stages of network access category of indicators. For example, Figure 9.7 on the staging for the 17 indicators shows that network access category of indicators for very large universities was at stage 1.5 and below except for the perception-based network speed and quality indicator at stage 2.6. The very large universities were also at stage 1.4 in ICT financing indicator which means they were spending less that 0.3% of their annual expenditure on Internet bandwidth. However, the universities still achieved stage 2.5 and above in ICT in libraries, ICT research and innovations, and enhancing education with ICT indicators that were all critical for learning and research. This was a surprising result that needed further investigation.

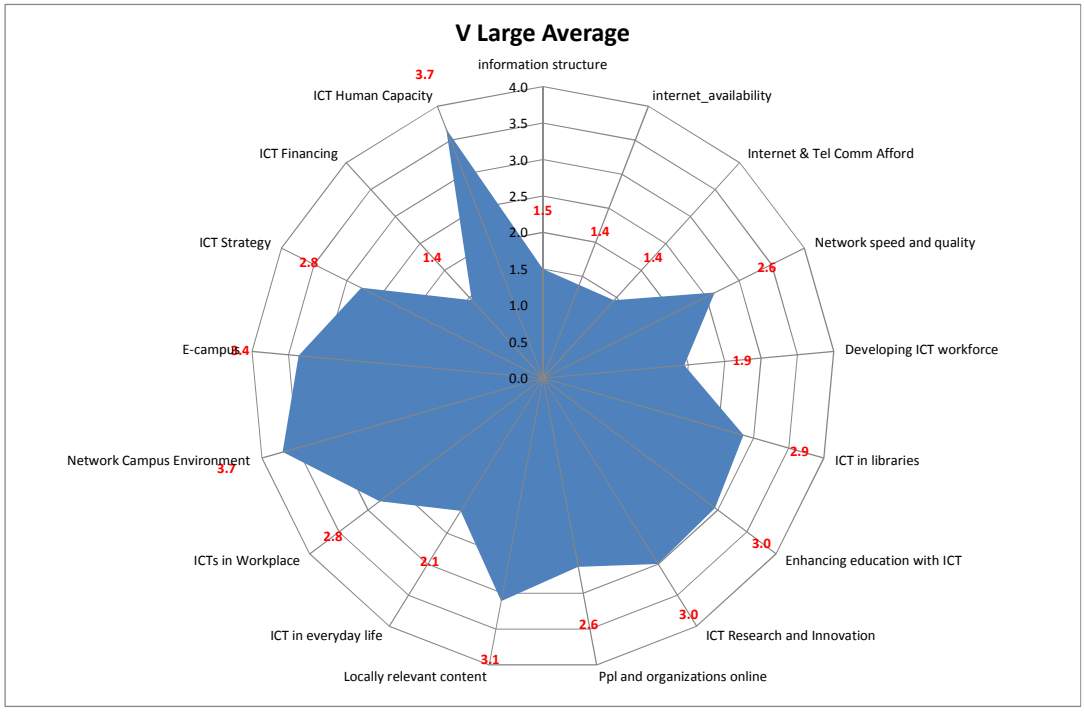


Figure 9.7: Summary of staging of 17 indicators for very large category of universities

The staging for the 17 indicators for the small universities is shown in Figure 9.8. The universities were at higher stages in network access category of indicators compared to the very large universities and were also allocating proportionately more resources for purchase of Internet bandwidth (stage 1.7 compared to stage 1.4 for very large universities). However, they were below stage 2.5 in the networked learning category of indicators where they were at stage 2.0 compared to stage 2.8 for the very large universities. This suggests that ICT strategy is a significant determinant in the readiness in the networked category of indicators.

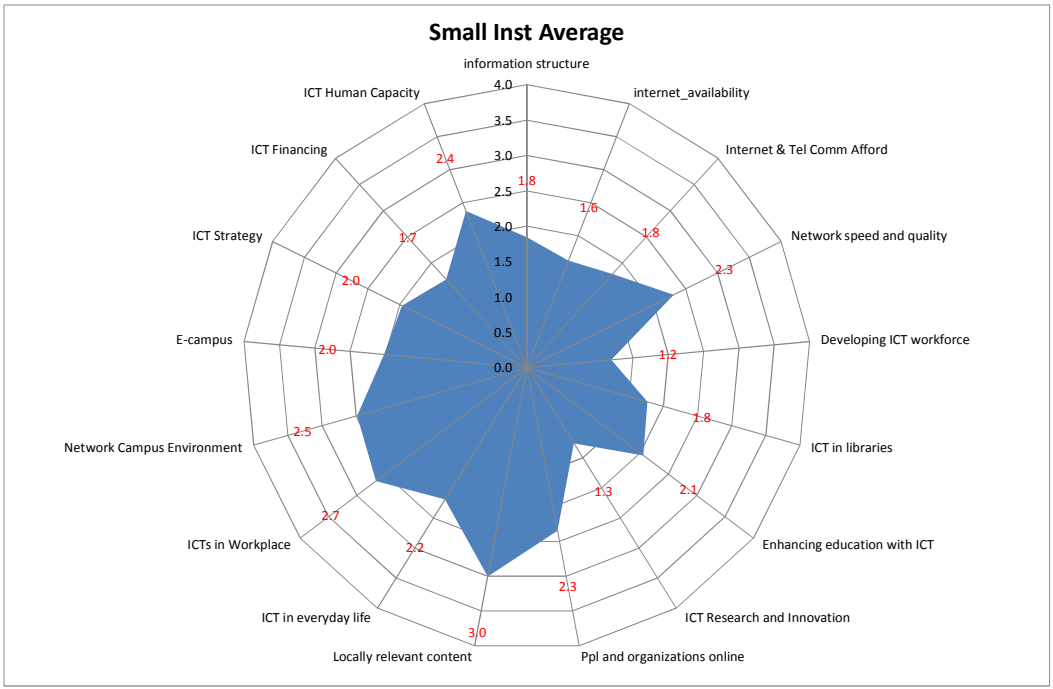


Figure 9.8: Staging of the 17 indicators for Small Category of universities

The large universities were at stage 1.9 in ICT strategy indicator as shown in Figure 9.9. Consequently, they were at stage 2.0 and below in three of the four indicators of networked learning category of indicators. This was despite the fact that they were at stage 2.3 in ICT financing compared to 1.4 for the very large universities. This means that allocation of more resources for Internet bandwidth does not always translate to more effective use of ICT in learning and research.

Figure 9.10 shows the staging for the medium-sized category of universities. These universities were at higher stages in the network access category of indicators but were in stage 2.0 and below in three of the four indicators of networked learning.

Thus, it does appear that ICT strategy indicator has a large impact on the staging of all the other indicators, particularly the networked learning category of indicators. This was also observed in the 2006 survey of Kenyan universities [Kashorda, 2007] but there was still need for further analysis.

In addition to the observation that the ICT strategy indicator had a significant impact on indicators that measure the impact of ICT on learning and research (i.e., networked learning), this study also analyzed the staging of the 15 strategic indicators identified in the 2006 e-readiness survey of Kenyan universities as described in the next section.

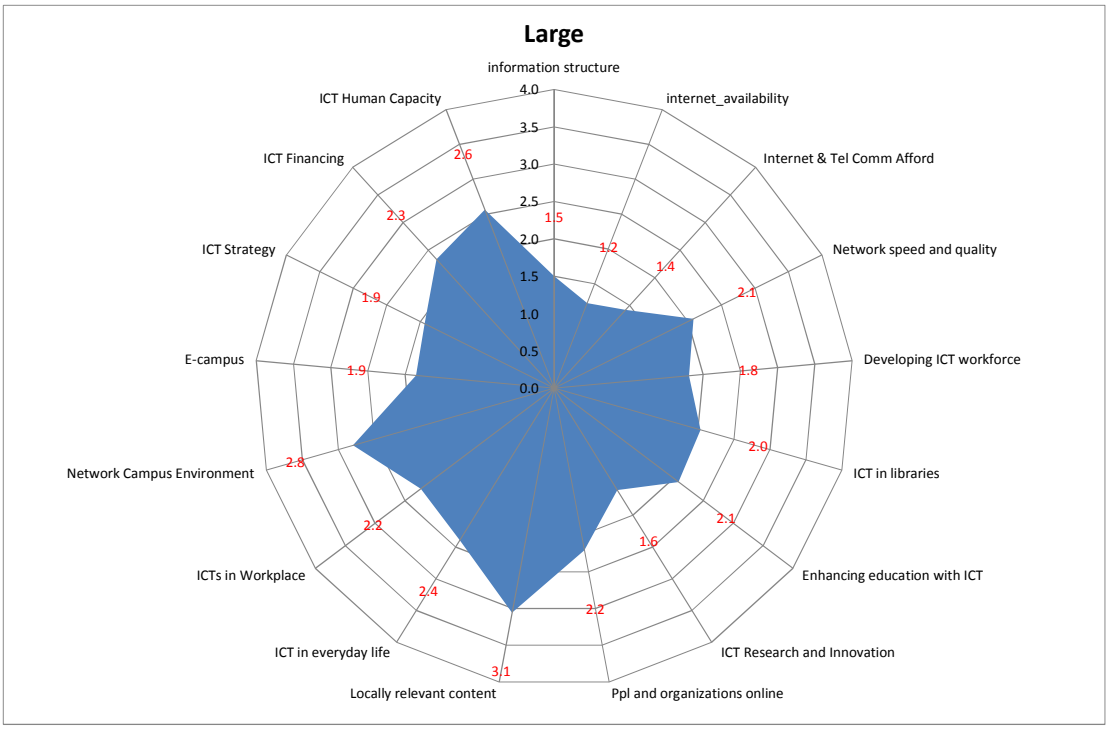


Figure 9.9: Staging of 17 indicators for large category of universities

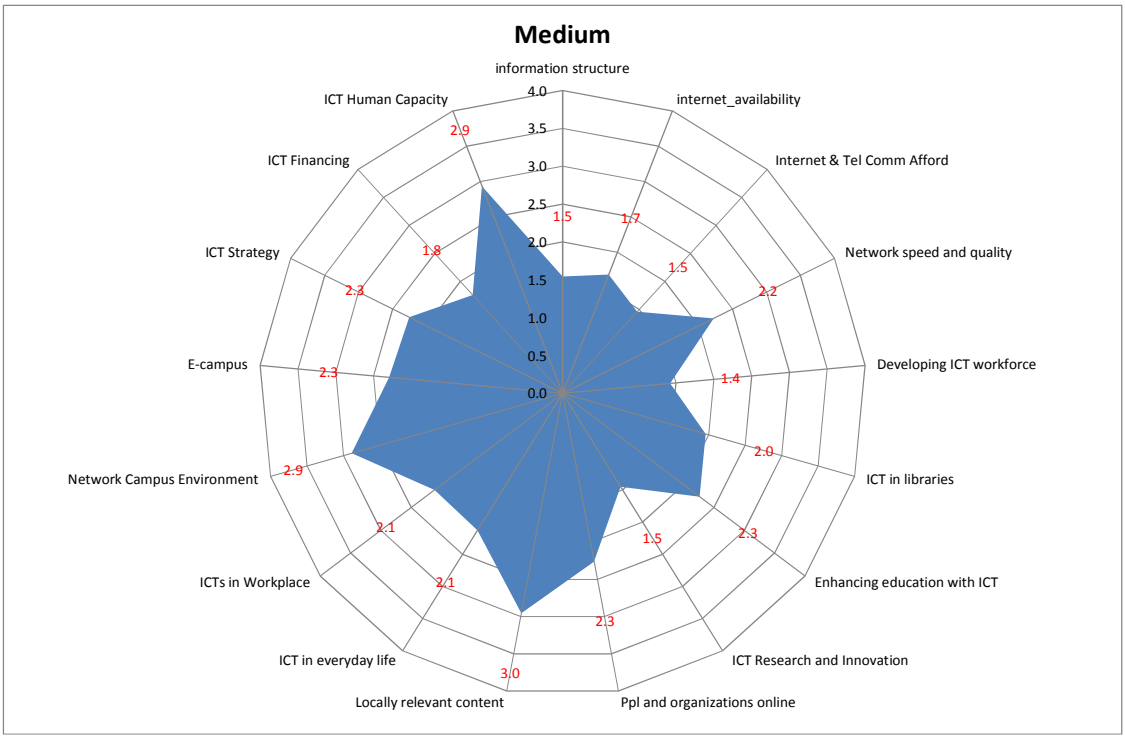


Figure 9.10: Staging for the 17 indicators for medium-sized category of universities

9.5 Strategic ICT sub-indicators

The 2006 survey of e-readiness of higher education institutions in Kenya identified 15 sub-indicators that were considered strategic. These sub-indicators, selected from over 60 sub-indicators, aimed to facilitate efforts by universities to incorporate indicators in their ICT and corporate strategies. Most Kenyan universities adopted two of the 15 indicators in their strategies, namely, PCs per 100 students and Internet bandwidth per 1000 students as simple measures for investments in ICTs in universities. While this study found that a greater proportion of students had access to PCs at home, about 50% of the students still access computers in cyber cafés because only a few of own computers. Universities therefore need to continue investing in campus-based computer labs to increase the use of ICT in learning and research by students.

Figure 9.11 on the staging for the strategic indicators for all the 48 universities included in the analysis indicates that nine of the 15 sub-indicators were below stage 2.0. For example, Internet bandwidth per 1000 students was at stage 1.4 and the networked PCs per 100 students was at stage 1.3. The universities were also spending minimally on Internet as measured by the Internet bandwidth cost per 1000 at stage 1.5. Consequently, the percent of student respondents with campus access to computers was at stage 1.3.

The results in Figure 9.11 also show that the sub-indicator percent of ICT implementation was only at stage 1.5. This means that only about 25% of the institutional ICT strategy had been implemented according to the staging framework. Thus, universities in East Africa will need to pay greater attention to ICT strategy and incorporate the strategic sub-indicators in their strategic plans. Figure 9.12 demonstrates the need for greater focus on the strategic indicators is still true even for Kenyan universities that were surveyed in 2006 where the staging of the indicators had not changed in the two years except for that the perception of campus networks that had improved. *This could also mean that accession to higher stages is a challenging change management process that requires focus on ICT by the senior leadership of the universities.* The second phase of this accession project will develop detailed institutional roadmaps showing the expected dates for achieving stage 4 in all of the 15 strategic indicators.

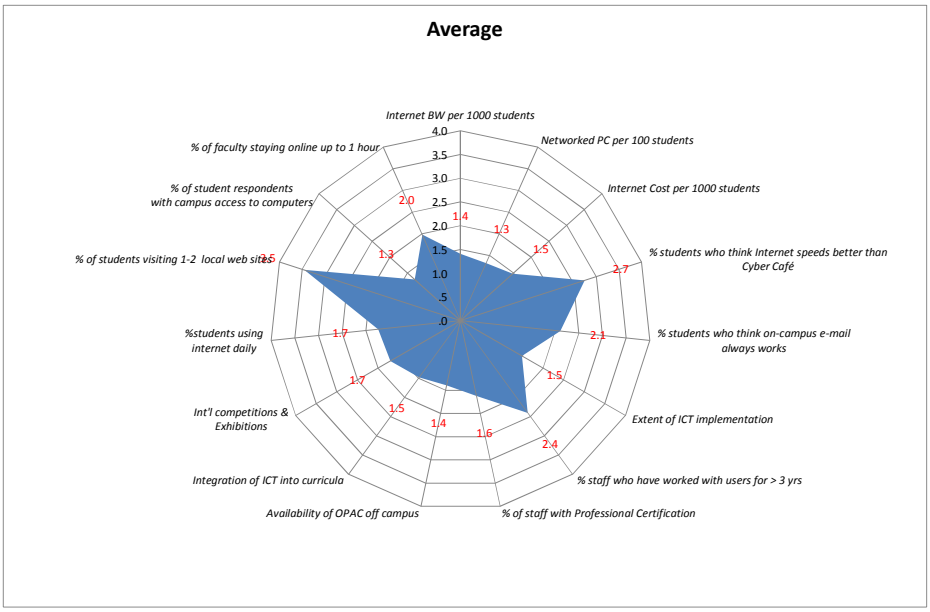


Figure 9.11: Average stages for 15 strategic indicators for all EA universities

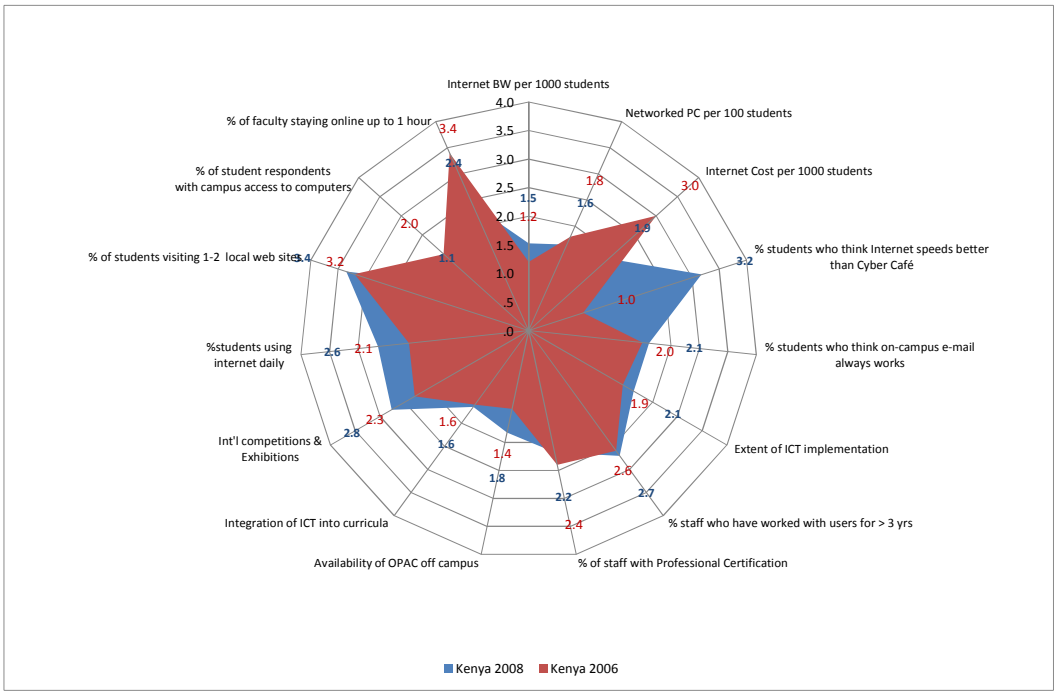


Figure 9.12: Average stages for 15 strategic indicators for Kenyan universities for 2006 and 2008

9.6 Conclusions

Although the availability of much cheaper undersea Internet bandwidth may mean that universities in East Africa achieve stage 4 in the strategic indicator of Internet bandwidth per 1000 students, this would not be possible without some increase in the Internet bandwidth cost per 1000 students. For example, at stage 1.9 in Internet bandwidth cost per 1000 student, meant that universities were spending about US$ 13,000 per 1000 students according to this staging framework [Kashorda and Waema, 2008b]. At a price of US$ 500 per Mb/s per month, this translated to only about 2.6 Mb/s per 1000 students. This was lower than the 5 Mb/s required for accession to stage 4. We note that the 5 Mb/s per 1000 students was based on what was possible with expensive satellite bandwidth at prices of about $2,100 per Mb/s per month. This target will need to be revised to be consistent with universities that have broadband Internet speeds provided using national and international optical fiber networks.

The universities lacked simple ICT indicators for measuring ICT readiness and usage. In Kenya the university leadership had difficulty in tracking the 15 strategic sub-indicators and only two indicators for PC ratio and Internet bandwidth ratio have been widely accepted and utilized. In phase 2 of this project, we shall aim to reduce the indicators to about five that would be considered critical for accession to the networked learning category of indicators. As a start, the focus will be on the following five indicators:

(i) Internet bandwidth cost per 1000 students
(ii) Internet bandwidth per 1000 students
(iii) PCs per 100 students
(iv) Extent of ICT strategy implementation
(v) Integration of ICT in curricula

It would also be desirable to monitor the ICT budget used to support learning, teaching, and research separately rather than to use the proxy of Internet bandwidth cost per 1000 students. However, most of the universities surveyed did not have unbundled ICT budgets and could not complete the questionnaire question regarding ICT budgets used to support academic work. Moreover, most universities treated ICT staff salaries as part of ICT budget and it was therefore difficult to get a total figure for ICT budget required in our assessment framework. We recommend that all universities create a separate budget line for ICT which includes Internet bandwidth, academic campus networks, and the associated salaries of ICT professionals.

Some of the leading universities were starting to provide wireless access on campus for students who own computers. This has improved access to learning resources. This data was not captured in this survey for the following reasons:

a. Lack of hard facts data on the number of students who owned computers and a separate study was required.
b. Anecdotal data indicates that most of computers owned by the students and were not yet connected to the campus networks, and were used mainly for entertainment rather than learning.
c. The majority of students still did not own computers and depended on university computer labs and/or cyber cafés
d. There was limited impact of personal computers or laptops in the universities because they were not shared as compared to shared computers in the campus laboratories or cyber cafés

In future surveys, data on student and faculty who owned computers that are connected to the university networks will be considered in staging the Internet availability indicator. We note that the results of 2008 perception survey show that only about 25% of the student respondents had access to computers at home but no data was collected on ownership of computers.

Another sub-indicator that was not considered in staging Internet availability was mobile Internet. Since about 50% of the student respondents reported that they were using mobile Internet, this will need to be factored in staging of the Internet availability indicator. However, if the student respondents accessed the Internet from their mobile phones, then there was need for further research on the use of mobile phones to access learning resources. The results of the research would inform any changes in the strategic plans of the universities. Phase 2 of this project on innovative ICT projects will therefore give priority to innovative mobile learning technologies because of the pervasiveness of mobile phones among the students (over 98% have mobile phones).

Internet availability and affordability are critical for widespread adoption of ICT in learning. However, our results have shown that accession in Internet availability does not always translate to accession in networked learning category of indicators. Our results also suggest that accession of the ICT strategy indicator is correlated to accession of the networked learning indicators. Although further research work is required, we note that accession in ICT strategy indicator requires that the Vice Chancellor is the ICT champion of the university and that the ICT director position is elevated to reporting directly to the VC. In fact, universities where the VC was considered the ICT champion were at higher stages in the networked learning category of indicators.

One of the critical indicators of networked learning is ICT research and innovation. This indicator indirectly measures the quality of ICT degree programs (if they can participate in international competitions they must be of international standard). It also measures the availability of Masters and PhD degree programs required for enhancing the capacity of universities to create high quality degree programs. This indicator was at stage 1.5 for the East African universities. Despite 72% of the universities surveyed reporting offering undergraduate degree programs, only 12% of the universities offered doctoral studies in any area of ICT. Accession of this indicator must be a long term strategic goal of the universities and was not directly related to availability of cheap Internet bandwidth. It is important that universities initially develop a consortium approach to increasing the Master's and PhD throughput in ICT and it will require significant ICT capacity development budgets. This should be a priority area for development support of the potential of enhancing quality of education and partnerships using ICT is to be achieved.

This survey had clearly demonstrated that the size of the university matter though the reasons for this are not clear. The researchers had expected small universities to adopt ICT faster and to transform learning. But the results suggest that it is the very large and well-established that were more effectively able to transform learning using ICT as measured by the higher staging in networked learning category of indicators. However, we recognize that a key weaknesses in the data set used to stage the networked learning category of indicators was that it was not normalized. For example, we collected data on Master's and PhD degree programs that were offered by the universities but not the throughput of the programs or even the enrollment. We also did not measure the percentage of ICT students participating in exhibitions but rather just used a Yes/No question. Similarly, we did not count the fraction of on-line courses offered as a percent of the total number of courses offered by the university. This was because the data was not easily available as most universities did not track the data on on-line courses, graduation

rates, and ICT projects that were being exhibited in a centralized database. A separate detailed study would therefore be required for ICT programs to collect such data. We recommend that universities start tracking such data so that be used for more accurate staging the networked learning category of indicators in the future.

10. CRITICAL ISSUES AND GENERIC ROADMAPS

This chapter outlines critical issues and recommendations for the five categories of indicators of the e-readiness assessment framework described in Chapter 2. The critical issues are derived from the poor the results reported in Chapters 4 to 8 and the summary of findings and conclusions in Chapter 9. It also presents generic roadmaps for accession into higher stages in each of the five categories of indicators.

10.1 Network Access

Two critical issues identified were insufficient budgets for Internet bandwidth for students and staff and inadequate access by users to networked PCs. The overall unweighted average network access stage for universities is stage 2 or below. For example, the study found that the average PC ratio was only 5.3 PCs per 100 students. According to our staging framework, the universities are at the beginning of stage 2 for networked PCs per 100 users. Although some of the universities were starting to provide wireless access to Internet for their students by building hotspots, over 50% of the students still had to use cyber cafés for computer and Internet access.

Table 10.1: PCs dedicated to students

	Student PCs	Total PCs	Student PCs as % total PCs
Kenya	8544	19042	44.9
Rwanda	2367	3320	71.3
Tanzania	1130	20950	5.4
Uganda	6246	8877	70.4
Burundi	308	658	46.8
Total	**18,595**	**52,847**	**35.2**

Table 10.1 shows the PCs dedicated to students in comparison to total institutional PCs. In most countries, except Rwanda and Uganda, the number of PCs dedicated to students is very low compared to the total number of PCs in the universities. Tanzania seems to have an acute problem, which may need further investigation. With students accessing on average 35% of the PCs in the institutions, the universities in the region are paying more attention to faculty and administrative staff compared to students in provision of PCs. That also may explain why a high percentage had to use cyber cafés.

In the short-term, universities should aim to be in the middle to top of stage 2, which is 10 and 20 PCs to 100 users respectively (or 1:10 and 1:5 PC to user ratio, respectively). This can be done by implementing wireless access in student halls of residence to connect those who own their own computers and at the same time creating cyber cafés in strategic locations. They should also find innovative methods to move to stage 3 in the medium term (20-49 PCs per 100 users). Stage 4 requires at least a 1:2 PC user ratio (or at least 50 PCs to 100 users), which is the ultimate goal.

In order to transition to stages 3 and 4, universities will require innovative strategies. These include use of thin clients in student labs and cyber cafés. However, given restrictions in space for laboratories and cyber cafés in most campuses and halls of residence, universities will have to find a strategy to encourage students to buy their own personal laptop or notebook computers. Anecdotal evidence shows that an increasing number of students already have their own laptop computers. Given the limited funding of university students, universities will need to create a

mechanism to encourage ownership of PC by as many students as possible, e.g. through a loan scheme.

The perception survey data results showed that 50.35% of the male respondents were using mobile Internet compared to 46.75% of female respondents. Thus, students in East African universities are actively using mobile Internet, mostly from their mobile phones rather than as a modem for their PCs. This suggests that mobile Internet will play a significant in access to learning resources by students and this should to be a new area for research. The use of mobile Internet is therefore a strategy that should be explored.

The study also found that average Internet bandwidth was only 430 kb/s per 1,000 students. According to the staging framework, the universities are still on stage 1 for Internet bandwidth per 1,000 students. In the short-term, institutions should aim to have total Internet bandwidth of at least 1,000 Kb/s per 1,000 students, which is at the beginning of stage 2 (640 Kb/s to 2.5 Mb/s per 1,000 students). In the medium-term, this bandwidth should be increased for the institutions to be in stage 3 (2.5 – 5 Mb/s per 1,000 students). The long-term requires Internet bandwidth greater than 5 Mb/s per 1,000 students.

Stage 2 can easily be achieved with satellite bandwidth. With total Internet bandwidth between 1 Mb/s to 2 Mb/s, institutions would need to spend US$ 23,100 to US$ 46,200 per year at the average satellite bandwidth tariffs of US$ 2,100 per Mb/s per month. However, stages 3 and 4 are not possible with the prevailing satellite bandwidth tariffs. It is therefore recommended that universities ensure they have access to submarine cable bandwidth in order to accession to stages 3 and 4. This bandwidth is likely to retail at less than US$ 500 per Mb/s per month. For example, cost of stage 4 (over 5 Mb/s) of cable bandwidth is about the cost of 1 Mb/s of satellite bandwidth, which is stage 2. Universities in stage 2 in the Internet bandwidth ratio sub-indicator will therefore be able to transition to stage 4 without increasing their Internet bandwidth budget. It is therefore important that institutions increase rather than reduce their Internet bandwidth budgets. Although universities may be able to transition to stage 4 of the Internet bandwidth ratio sub-indicator they will not transition to stage 4 of the Internet availability category of indicators unless they also expand their campus networks.

It may take some time before many institutions enjoy the undersea bandwidth. Each country will need to have implemented a national fiber backbone infrastructure. The countries are at different stages of implementation of this fiber infrastructure. For example, Kenya has already completed laying this infrastructure while Tanzania expects to have it completed by 2010. In Kenya, this infrastructure was implemented by the government and procurement of an operator to operate it is on-going. This procurement may take a long time in Kenya, going by past experience for procuring large projects by the government.

In addition to the national fiber backbone infrastructure, each institution will need to construct fiber-based local access infrastructure. This infrastructure can take a long time, given the need to obtain rights of way from local governments and other authorities that own different types of infrastructure. Kenya has been quite fortunate in that the local access fiber infrastructure has been constructed for all KENET member institutions using funding from government. Universities in Kenya can therefore start enjoying fiber bandwidth once it goes live in the country.

The final critical issue is the low quality of the network infrastructure and services. For example, about 56% of the students considered cyber cafés better than campus networks in terms of Internet speed and over 50% of the students accessed computers and Internet off-campus at

cyber cafés. In addition, about 55% of the students considered the campus networks unstable. In order to improve the quality of the network infrastructure and services, we recommend that institutions improve the quality of their network infrastructure. This involves re-designing their networks, improving the quality and reliability of the servers and network equipment and effectively supporting the infrastructure.

The critical issues and accession strategies for network access are summarized in the Table 10.1. The table also shows the time and resources or initiatives required to implement the accession strategies for institutions with staging above stage 3, between stages 2 and 3 and below stage 2.

Table 10.1: Critical issues and generic roadmap for network access indicators

Critical issues	**Accession strategy**	**Time and resources/initiatives required**		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Inadequate Internet bandwidth	Increase the total Internet bandwidth to at least 1 Mb/s per 1,000 students in the short-term	• N/A (already there)	• N/A (already there)	• Immediate • Expenditure on satellite Internet bandwidth of at least US$ 23,100 per 1,000 students per year
	Increase the total Internet bandwidth to over 5 Mb/s per 1,000 students in the medium-term Ensure access to undersea cable bandwidth Increase Internet budgets	• In 3-6 months • Expenditure on cable Internet bandwidth of US$30,000 plus per 1,000 students per year (assuming US$ 500 per Mb/s and cable bandwidth has landed in the institutions)	• In 3-6 months • Expenditure on cable Internet bandwidth of US$ 30,000 plus per 1,000 students per year (assuming US$ 500 per Mb/s and cable bandwidth has landed in the institutions)	• In 3-6 months • Expenditure on cable Internet bandwidth of US$ 30,000 plus per 1,000 students per year (assuming US$ 500 per Mb/s and cable bandwidth has landed in the institutions)
Low access to networked PCs by staff and students Universities paying more attention to faculty and admin staff compared to students in provision of PCs	Increase the ratio of networked PC to student ratio to an average of 1:10 to 1:5 Explore the use of Mobile Internet to increase student access to Internet	• N/A (already there)	• N/A (already there)	• In 1-2 years depending on size (ready for cable Internet bandwidth) • Investment in extending network infrastructure on campus and student halls using variety of technologies and on average doubling the number of PCs
	Increase the ratio of networked PC to student ratio to an average of 1:5 to 1:2	• N/A (already there)	• In 2 years • Investment in extending network infrastructure on campus and student halls using variety of technologies and on average doubling the number of PCs	• In 3 years • Investment in extending network infrastructure on campus and student halls using variety of technologies and on average doubling the number of PCs
Low quality of the campus	Improve the quality of network infrastructure and	• N/A (already there)	• In 6 months • Investment to improve the quality	• In 1 year • Investment to improve the quality

Critical issues	Accession strategy	Time and resources/initiatives required		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
network infrastructure and services	services		of network infrastructure and support services	of network infrastructure and support services

10.2 Networked Campus

The networked campus category contains only two indicators: network campus environment and the e-campus. The study found that the overall staging for these indicators for all the universities surveyed is stage 2.5. More specifically, universities were in higher stages in network campus environment indicator than in e-campus indicator. At stage 2.8 in the former, most of the universities were ready for extensive use of ICT to support teaching, learning, research, and management. For example, about 65% of all institutions had uninterruptible power supply (UPS) for PCs in the office while 58% of the PCs in the student labs had a UPS. Despite this relatively good performance, the study found that about 30% of the universities were not ready for external threats to their networks and did not take such threats seriously. Moreover, only about 37% of the universities had an off-site back-up and 26% had a disaster recovery plan. The critical issue is therefore that most of the universities in EA do not yet consider disaster management a priority. To address this, the institutions have to develop and implement disaster recovery plans as part of their ICT strategic plans. Given that a disaster recovery infrastructure can be very expensive for individual institutions, we recommend that a shared disaster recovery program is implemented at NREN level. This could cost each institution between US$ 15,000 to US$ 50,000, depending on its size. In Kenya for example, institutions are already requesting KENET to host their servers.

A second critical issue is the low performance in e-campus indicator. This indicator was measured using a variety of sub-indicators such as the frequency of website updates, the extent of online interaction with suppliers, the degree of automation of the campus processes and the integration of the information systems. All universities were found to be below stage 3 in this indicator. This means, for example, that websites were not being updated frequently (e.g., weekly) and there was limited online and e-mail interaction with suppliers, students, employees, and other stakeholders. For example, only 30% of universities updated their websites weekly. Most of the universities were unable to provide information on extent of electronic interaction with suppliers or the value of the online business transactions.

The relatively low performance in e-campus indicator suggests lower levels or a general absence of integrated management information systems (MIS) applications. To this end, institutions should acquire, implement and sustain integrated MIS applications. These applications are very expensive and institutions should leverage on open source software (OSS) solutions, which have a lower total cost of ownership. Perhaps NRENs could facilitate forums where institutions can learn from each other on deployment of open source software MIS applications. NRENs could go further and organize training on key OSS MIS applications.

We also recommend that these systems are implemented and supported by qualified and motivated information systems professionals. To this end therefore, institutions should therefore hire and retain quality professional staff as recommended under the section on institutional ICT strategy below.

The final critical issue is managing resistance to change in implementing MIS applications in universities. This issue is responsible for limited adoption of some of the key MIS applications. In order to address this challenge, we recommend that institutions create change management programs for each MIS application to be implemented. This program could include business process mapping and re-engineering (BPM/BPR), workshops to explain the benefits of the new system, training of all categories of users, incentives/sanctions for adoption, etc. This program will need to be an integral part of the roll-out of each MIS application.

The critical issues and accession strategies for networked campus are summarized in the Table 10.2. The table also shows the time and resources or initiatives required to implement the accession strategies for institutions with staging above stage 3, between stages 2 and 3 and below stage 2.

Table 10.2: Critical issues and generic roadmap for networked campus indicators

Critical issues	**Accession strategy**	**Time and resources/initiatives required**		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Lack of disaster recovery plan	Implement a shared disaster recovery program at NREN level	• In 1-2 years (depending on funding availability) • US$15,000 – $50,000 investment depending on size	• In 1-2 years (depending on funding availability) • US$ 15,000 – $50,000 investment depending on size	• In 1-2 years (depending on funding availability) • US$15,000 – $50,000 investment depending on size
Lack of integrated MIS applications	Acquire, implement and sustain integrated MIS applications	• In 1 year • Investment to integrate existing MIS applications	• In 1-2 years • Investment to implement missing core MIS applications	• Over 3 years • Investment to implement core MIS applications. Consideration to be given to OSS applications
	Hire and retain qualified information systems professionals	• Addressed under institutional ICT strategy	• Addressed under institutional ICT strategy	• Addressed under institutional ICT strategy
Resistance to change by users	Create change management programs for each MIS application and implement it as an integral part of the application roll-out	• In 1 year • Investment in change management program (BPM/ BPR, "selling" workshops, training, incentives/ sanctions for adoption, etc.)	• In 1-2 years • Investment in change management program (BPM/ BPR, "selling" workshops, training, incentives/ sanctions for adoption, etc.)	• In 2-3 years • Investment in change management program (BPM/ BPR, "selling" workshops, training, incentives/ sanctions for adoption, etc.)

10.3 Networked Learning

One critical issue was the minimal integration of ICT in curriculum. The study found that universities in East Africa were at stage 2.2 in the indicator enhancing education with ICT. This means that institutions were at the initial stages of using ICT in learning and teaching. For example, only 28% of the universities reported to be using e-learning in some of their courses. Furthermore, data on the percentage of courses that were being supplemented by e-learning materials was not available. That is, most of the universities were not even tracking progress on development of e-learning materials by faculty. It is however to be noted that the sub-indicator

was not normalized. This was largely because there was lack of normalized data on networked learning sub-indicators, e.g. percentage of online courses.

One strategy is to review their curricula with a view to integrating ICT. In this review process, industry stakeholders should participate in order to ensure relevance. A second strategy is for institutions to increase the percentage of on-line courses. In the immediate to medium-term, over 25% of the courses should be on-line while in the long-term this percentage should be over 50%.

The second critical issue is the limited off-campus access to library resources by users. For example, only 27% had Online Public Access Catalog (OPAC) available off-campus. This means that most of the university libraries were not yet ready to provide digital library services. The strategy to address this is for institutions to enhance or accelerate their library automation activities and ensure that all resources are available over the Internet. A new proprietary system could cost over US$ 100,000. Institutions could make use of open source library automation systems, which many universities are increasingly adopting and are cheaper.

A further critical issue is the limited ICT research and innovations. The stage for ICT research and innovations indicator was low, at stage 1.5. A low score suggests few institutions were offering Master's and doctoral degrees in ICT or participating in the exhibitions. For example, only 30% of the universities were offering Master's degrees in ICT and only 11% were offering doctoral degree programs in ICT. Furthermore, only 43% of the universities participated in national or international exhibitions. One strategy to address these challenges would be for the larger private and public universities to develop ICT Masters and PhD degree programs to increase enrollment in these programs. For PhD programs, one of the best strategies is through collaboration. For example, one of the universities with better human capacity for supervision could offer the program in collaboration with other universities. The other universities without a program could then send students to this university and collaborate in PhD supervision. With time, these institutions would create the necessary capacity to offer their own programs.

One of the measures of the learning outcomes of ICT graduates is the quality of ICT projects and participation in national and international competitions and exhibitions. The second strategy to address this issue is for universities to improve the quality of student ICT projects to international standards to ensure a higher level of innovation.

Another critical issue is the lack of operational course management system for e-learning. The recommended strategy is to set up a course management system. In addition, it is recommended that instructional designers and administrators should be hired in order to achieve the set online courses targets.

A further critical issue is the lack of local research databases and limited participation in research networks. For example, the results show that only about 17% of the lecturers had setup or were using research databases. This means the use of ICT and Internet for research by faculty is far from becoming pervasive. The strategy to address this is to increase research funding for development of research databases and integration of such activities in the evaluation of lecturers.

Finally, lack of training is a critical issue. The study found that developing the ICT workforce was one of the sub-indicators with the worse performance (overall stage of 1.5), especially in small universities (stage 1.2). This means that there is limited training for technical ICT staff on professional courses and e-learning and limited faculty training on e-learning, productivity tools

and other internal ICT training. Addressing this means aggressive capacity building for both technical ICT staff and faculty.

The critical issues and accession strategies for networked learning are summarized in the Table 10.3. The table also shows the time and resources or initiatives required to implement the accession strategies for institutions with staging above stage 3, between stages 2 and 3 and below stage 2.

Table 10.3: Critical issues and generic roadmaps for networked learning indicators

Critical issues	**Accession strategy**	**Time and resources/initiatives required**		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Minimal integration of ICT in curriculum Lack of normalized data on networked learning sub-indicator (e.g. % of online courses)	Review curricula and integrate ICT with industry input	• N/A (already there)	• N/A (already there)	• In 1 year • Workshops to review curricula
	Increase the percentage of on-line courses to 25% in the immediate to medium-term and over 50% in the long-term	• In 1-2 years • Investment in training + development of additional on-line courses (to achieve 25% to 50% online courses)	• In 2 years • Investment in training + development of additional on-line courses (to achieve 25% to 50% online courses)	• In 3-4 years • Investment in e-learning platforms + training + development of on-line courses (to achieve at least 25% online courses)
Limited off-campus access to library resources	Enhance or accelerate library automation	• N/A (already there)	• In 1 year • Investment in enhancing library automation	• In 2 years • Investment in new library system + training + roll-out
Limited ICT research and innovations	Create in ICT Masters and Ph.D. programs and increase enrollment in these programs. The latter could be achieved through consortium PhD program	• In 1 year • Cost of developing and advertising Ph.D. programs	• In 1 year • Cost of developing and advertising both Masters and Ph.D. programs	• In 1 year • Cost of developing and advertising Masters programs (may not have capacity for PhD programs)
	Improve quality of student ICT projects to international standards	• N/A (already there)	• In 1 year • Cost of sponsoring students in Int'l competitions & exhibitions + good project supervision	• In 2 years • Cost of sponsoring students in Int'l competitions & exhibitions + good project supervision
Lack of operational course management system for e-	Set up a course management system	• N/A (already there)	• In 1 year • Cost of (course management system + training + roll-out)	• In 1 year • Cost of (course management system + training + roll-out)

Critical issues	Accession strategy	Time and resources/initiatives required		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
learning				
	Hire instructional designers and administrators	• In 1 year • Cost of additional instructional designers	• In 1 year • Cost of instructional designers and administrators (assume an e-learning unit exists)	• In 2 years • Cost of (creating an e-learning unit + instructional designers and administrators)
Lack of local research databases	Increase funding for development of research databases	• In 6 months • Cost of facilitating staff to use research databases	• In 1 year • Cost of setting up & facilitating staff to use research databases	• In 2 years • Cost of setting up & facilitating staff to use research databases
Limited training for technical ICT staff and faculty	Aggressive training for technical ICT staff and faculty	• NA (already there)	• In 1 year • Investment in training ICT staff on professional courses and e-learning and faculty on e-learning and other productivity tools	• In 1-3 years, depending on size • Investment in training ICT staff on professional courses and e-learning and faculty on e-learning and other productivity tools

10.4 Networked Society

The study results show that all institutions achieved an average stage 2.5 on the four indicators in this category. This means they were ready to use ICT for learning, research, communications and management. More specifically, the results show that all institutions are at, or close to stage 3 on locally relevant content. This means that there is a significant amount of local content and both faculty and students are accessing this content. However, the usage is still relatively low due to network access challenges, resulting to low scoring for the people and organizations online at 2.3. This suggests that staff and students in universities have about average access to on-line resources in the campus networks. For example, although stage 4 score requires that over 50% of the students use the Internet daily, none of the universities achieved this.

A critical issue therefore is access to and usage of computers and the Internet. The overall stage for ICT in everyday life is 2.2, which suggests limited use of ICT. The study found that only 23% of faculty reported having access to computers in their offices, and about 35% of the non-teaching staff had access to computers at work. This is almost at stage 2 that requires that 25-49.9% of users have access to computers at work. This is supported by the findings that about 54% of the respondents had off-campus access to e-mail, that about 27% of the respondents thought on-campus e-mail always worked and that 45% and 56% of faculty and students respectively think that Internet speed on campus are worse than those of cyber cafés or other ISPs. This demonstrates that on average, universities have not invested sufficiently in computers for staff and faculty and the quality of the infrastructure is poor.

The study also found that over 50% of the students' access computers and the Internet in cyber cafés. In addition, only 8% of the students reported their primary access to computers was on campus. The inconvenience and cost of accessing Internet and computers in cyber cafés could

explain the relatively low use of Internet resources for learning. The study also shows that the academic staff was making progress in creating online content. They are however frustrated by the low speed and low quality of ICT services as outlined under critical issues in network access. It appears that addressing the critical issues in the network access, networked campus and networked learning categories of indicators would further improve performance in networked society indicators.

As one of the ways to circumvent access problems, mobile Internet was found to be a growing phenomenon. The study found that 45% of the faculty members were already using mobile Internet services. The 2006survey found that only 25% of faculty were used mobile Internet in Kenya. This illustrates how quickly mobile Internet is growing in the region. The study also found that over 60% of the users in Kenya and Tanzania use the mobile phone for Internet access. One of the strategies to address the access problems is therefore to introduce wireless access in campuses.

Another critical issue in networked society is the lack of interactive institutional websites. The study found that about 16% of the institutions do not have a corporate website. The study also found that less than 28% of staff and 18% of students classified their websites as interactive while over 50% of the users surveyed (57% staff and 53% students) classified their websites as informational. The study recommends that institutions should set up interactive and up-to-date Web sites that are driven by Internet-enabled academic and administrative information systems, especially the core business systems (student, finance and library information systems). We also recommend that these systems are implemented and supported by qualified and motivated information systems professionals.

A final critical issue identified in this category of indicator concerns lack of understanding of the needs of these institutions by the institutional leadership and ICT departments. For example, all of the staging for the sub-indicators of locally relevant content and people and organizations online was based on the perceptions survey of the university community. In most cases, this is the first time such a survey had been conducted, except for Kenya. This means that the institutions did not know, for example, that students were finding the cyber cafés better than the campus-based network services. The institutions also did not know how the community was using the Internet and campus networks. The study therefore recommends that each institution commissions user surveys once every year as a feedback to the ICT strategy implementation.

The critical issues and accession strategies for networked society are summarized in the Table 10.4. The table also shows the time and resources or initiatives required to implement the accession strategies for institutions with staging above stage 3, between stages 2 and 3 and below stage 2.

Table 10.4: Critical issues and generic roadmap for networked society indicators

Critical issues	Accession strategy	Time and resources/initiatives required		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Limited access to networked PC	Addressed under Network Access	•	•	•
Lack of interactive institutional Web sites	Implement and sustain Internet-enabled core business systems (student, finance and library information systems)	• In 1 year • Acquisition & implementation of missing core MIS applications	• In 2 years • Acquisition & implementation of missing core MIS applications	• In 3 years • Acquisition & implementation of core MIS applications
	Setup interactive websites linked to MIS applications	• Immediately • Upgrade of an existing Web site	• Immediately • Upgrade of an existing Web site	• Immediately • Development of a new Web site
	Hire and motivate qualified Information Systems (IS) professionals	• Immediately • Motivators for existing IS staff	• In 1 year • Recruitment of additional IS staff and motivators	• In 2 years • Recruitment of new IS staff and motivators
Lack of customer survey data	Commission comprehensive surveys of the users annually and update indicators in this category	• In 1 year • Consultancy for user survey (as part of customer satisfaction survey)	• In 1 year • Consultancy for user survey (as part of customer satisfaction survey)	• In 1 year • Consultancy for user survey (as part of customer satisfaction survey)

10.5 Institutional ICT Strategy

The study found that institutional leadership does not yet consider ICT strategically important for teaching, learning, and research. This is exemplified by the low resource allocation to ICT. The study used expenditure on Internet bandwidth as a percentage of the total institutional expenditure as a proxy sub-indicator for ICT expenditure as a percentage of the total institutional expenditure. This was due to difficulty in getting ICT expenditure data from the universities. The study found that on average universities were below stage 2 (stage 1.7) on the ICT financing indicator. According to our framework, this means that institutions are spending less than or about 0.3% (definitely less than 0.5%) of their total budgets on Internet bandwidth. In addition, the resource allocation is not sensitive to the student numbers. As was argued under section 10.1 on network access, universities were purchasing very few computers for students in comparison to other users.

This critical resource allocation issue can be addressed by raising awareness of the strategic role of ICT in transforming universities amongst senior management, allocating at least 3% of the total institutional budget to ICT (excluding personnel emoluments) and raising the level of the ICT Director to a grade just below the level of a Deputy Vice-Chancellor, if not already at this level. Although the sub-indicator Internet bandwidth expenditure as a percentage of total institutional expenditure was used, this was a proxy for total ICT expenditure as a percentage of total institutional expenditure. For example, University of Nairobi spends at least 2% of its total budget on ICT. With an annual budget of about US$ 125 million 3% would mean over KSh. US$ 1.25 million additional expenditure on ICT. In addition, the increased ICT budget must be student-centred, otherwise the accession to higher levels of readiness will not take place.

The lack of financial data can be addressed by maintaining ICT financial data as part of the financial management system of a university. This can be achieved by reviewing the financial system to ensure ICT budget and expenditure has a budget line.

A second critical issue concerns the reporting level of head of ICT and the championship of ICT in institutions. The study found that in only 18.5% of the institutions do the heads of ICT report to the Chief Executive Officer (CEO) while in over 65% of the cases, the head of ICT reports to a Dean/Director or lower. This means that the strategic profile of ICT is still low at most of the institutions. The study also found that only 20% of the institutions reported that the champion for the ICT strategy is the CEO. This means that most ICT departments or divisions report lower than the CEO. In general, the information systems literature has shown that the reporting level of ICT (and we would add the championship of ICT) can be associated with higher impacts of ICTs in organizations.

In Kenya this is illustrated by University of Nairobi and United States International University where the ICT function reports directly to the Vice-Chancellor and the CEO/senior management is the ICT champion. These universities had generally higher levels of e-readiness than other universities where this was not the case. The strategy to address this issue is therefore to reorganize to enable the head of ICT to report directly to the Vice-Chancellor and be a member of senior management. In this enhanced status, the ICT function will have a broad view regarding systems priorities and be able to effectively link these priorities to key business needs across the institution. It is also recommended that CEOs and their senior managers take a keener interest in ICT and begin championing ICT in their institutions.

The third and related critical issue is the low level of alignment of ICT strategy to corporate strategy. The study found that only a third of the institutions had a 75-100% alignment of their ICT strategies to the corporate strategic plans. The percentage of institutions that reported that at least 50% of their ICT strategies are aligned to the corporate plans was 67% or two-thirds. This means that there are many ICT projects and activities that did not support the core mission of the universities, for example, improved learning outcomes of the graduates or management efficiency. This issue could partly be addressed by elevating the head ICT to at least Registrar level, if not higher. We further recommend that institutions adopt and make the strategic ICT sub-indicators identified in Chapter 2 an integral component of the corporate strategic plan and monitor these together with the other corporate performance indicators.

A related critical issue is the extent of ICT strategy implementation. The results show that on average the universities are below Stage 2 (Stage 1.5), which according to this methodological framework, on average all the institutions have implemented less than 50% of their ICT strategies. This represents a major challenge if ICT is to play a strategic role in these institutions. This challenge can be partly addressed using the same strategies as in the previous critical issues. These include elevating the head of ICT to senior management and integrating key strategic ICT sub-indicators outlined in Chapter 2 into the corporate strategic plan. An additional strategy is to create a sound monitoring and evaluation framework and to follow it.

The final critical issue is attracting and retaining qualified professional ICT staff. The research found in 42.6% of the cases, it was difficult to hire and retain key ICT staff. This confirms that most institutions have difficulties attracting and retaining their professional ICT staff. The finding is in line with realities in the region where professional ICT staff are in great demand and most universities cannot compete with the private business sector in attracting and retaining them. The recommended strategy is for universities to implement mechanisms for attracting and

retaining professional ICT staff. Two key mechanisms should include developing an attractive scheme of service and a robust staff development program for ICT staff.

The critical issues and accession strategies for institutional ICT strategy are summarized in the Table 10.5. The table also shows the time and resources or initiatives required to implement the accession strategies for institutions with staging above stage 3, between stages 2 and 3 and below stage 2.

Table 10.5: Critical issues and generic roadmap for institutional ICT strategy indicators

Critical issues	**Accession strategy**	**Time and resources/initiatives required**		
		Above stage 3	**Stages 2 – 3**	**Below stage 2**
Low resource allocation to ICT, especially for PCs for students	Allocate at least 3% of total institutional budget to ICT (excluding personnel emoluments)	• In next 1 yr • Additional budget for ICT capex and opex	• In next 2 yrs • Additional budget for ICT capex and opex	• In next 3 yrs • Additional budget for ICT capex and opex
Lack of ICT financial data	Maintain ICT financial data as part of the institutional financial management system	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item	• In next 1 year • Review of financial system to ensure ICT budget and expenditure is a line item
Low profile of ICT function	Raise the profile of ICT by upgrading the head of ICT to be at least at Registrar grade level, to report to the CEO and to become a member of senior management	• Immediately • Workshops and new statutes for ICT + increased salary of ICT Director	• Next 1 year • Workshops and new statutes for ICT + increased salary of ICT Director	• Next 2 years • Workshops and new statutes for ICT + increased salary of ICT Director
Low championship of ICT	CEOs and their senior managers to champion ICT in their institutions	• Immediately • Awareness workshops for senior management	• Next 1 year • Awareness workshops for senior management	• Next 2 years • Awareness workshops for senior management
Low level of alignment of ICT strategy to corporate strategy	Adopt and make the strategic ICT indicators an integral component of the corporate strategic plan and monitor these together with the other corporate performance indicators	• Immediately • Workshops to review existing corporate strategic plans	• Next 1 year • ICT and corporate strategic planning workshops	• Next 2 years • ICT and corporate strategic planning workshops
Incomplete implementation of ICT strategies	Create a sound monitoring and evaluation framework and follow it	• Immediately • Workshops to review existing M&E frameworks	• Next 1 year • Workshops to develop M&E frameworks	• Next 2 years • Workshops to develop M&E frameworks
Limited ability to attract and retain quality professional ICT staff	Implement mechanisms for attracting and retaining professional ICT staff (e.g. attractive scheme of service for ICT and putting in place a staff development program for ICT staff)	• Immediately • Workshops to review schemes of service and other mechanisms	• Next 1 year • Workshops to develop schemes of service and other mechanisms	• Next 2 years • Workshops to develop schemes of service and other mechanisms

The generic roadmaps in sections 10.1 to 10.5 will provide a guideline in creating institutional roadmaps for selected universities in the five countries. The institutional roadmaps will require more detailed institutional strategic analysis. As observed in Chapters 4 to 8, the staging varied from country to country and had a relationship with the size of the institution. For example, Kenyan universities with an aggregate of stage 2.4 were marginally at a higher stage than the universities in the other four countries, while Burundi universities were at the lowest stage of readiness for all indicators when compared to all other universities. An example on size is that the very large universities were in better state of readiness in both networked campus and networked learning categories of indicators in comparison to other size categories of universities while small universities were generally readier in networked society than medium universities and almost at the same level as large universities.

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APPENDIX 1 – LIST OF ASSOCIATE RESEARCHERS

Name	Job Title and Institution	Country	E-mail address
1. Ms Magreth Mushi	Assistant lecturer, Open University of Tanzania and Ag. Secretary, Tanzania Research and Education Network (TERNET)	Tanzania	Magreth.mushi@out.ac.tz
2. Eng. Albert Nzengiyumva	CEO, Rwanda Research and Education Network	Rwanda	Albert_nzengi@yahoo.com
3. Dr. Rachel Akimana	Lecturer and Director of ICT center, University of Burundi	Burundi	akimanarac@yahoo.fr
4. Dr. Patrick Mangheni	CEO, Research and Education Network of Uganda (RENU)	Uganda	Mangheni@renu.ac.ug

APPENDIX 2 – LIST OF RESEARCH ASSISTANTS BY COUNTRY

Burundi

Name	Institution
1. Ndayizeye Anastase	Université Lumière
2. Niyongere Onesphore	Université des Grands Lacs
3. Baraka Bonna Fidei	Université du Lac Tanganyika

Kenya

Name	Institution
1. Leah Mwaura	USIU
2. Walter Wanyama	USIU
3. Godwin Barechi	KENET
4. Kennedy Aseda	KENET
5. Maureen Njau	KENET/JKUAT
6. John Matogo	Strathmore University

Rwanda

Name	Institution
1. Mr. Rugamba Eric	Kigali Institute of Science and Technology (KIST)
2. Ms Umwali Solange	Kigali Institute of Science and Technology (KIST)
3. Mr. Gerald Rwagasana	National University of Rwanda
4. Ms Umuhoza Jeannine	Kigali Independent University
5. Ms Twahirwa Aline	Kigali Independent University

Tanzania

Name	Institution
1. Abdilah Abdulrahaman	Open University of Tanzania
2. Magreth Jubilate	Open University of Tanzania
3. Aristrarik Maro	Open University of Tanzania
4. Sigsbert Rwiza	Muhimbili Universiy of Health and Allied Science

Uganda

Name	Institution
1. Settaala Ibrahim Mustafa	Makerere
2. Mubiru Moses	Islamic University in Uganda (IUIU)
3. Okwalinga Michael	Makerere
4. Mubanda Davidson	RENU
5. Nansimbe Rahmah	IUIU

APPENDIX 3 – LIST OF PARTICIPATING UNIVERSITIES BY COUNTRY

Burundi

	Institution Name	Number of Students
1	Universite' du Burundi	12,000
2	Ecole Normale Supe'neure	2,000
3	UNIVERSITE LUMIERE DE BUJUMBURA	2,000
4	UNIVERSITE DES GRANDS LACS	1,300
5	UNIVERSITE DU LAC TANGANYIKA	3,237
	TOTAL	**20,537**

Kenya

	Institution Name	Number of Students
1	Kenyatta University	23,000
2	United States International University	4,493
3	Strathmore University	4,549
4	Masinde Muliro University of Science and Technology	4,500
5	Moi University	20,193
6	Jomo Kenyatta University of Agriculture and Technology	14,000
7	Catholic University of Eastern Africa	5,576
8	Daystar University	3,429
9	Maseno University	5,800
10	Kenya Polytechnic University College	9,393
11	University of Eastern Africa, Baraton	2,020
12	Mombasa Polytechnic University College	5,677
13	Egerton University	13,188
14	Kabarak University	1,100
15	Kenya Methodist University	4,210
16	Africa Nazarene University	1,200
17	University of Nairobi	39,991
	TOTAL	**162,319**

Rwanda

	Institution Name	Number of Students
1	Kigali Health Institute (K.H.I)	1,099
2	School of Finance and Banking (S.F.B)	2,471
3	Kigali Institute of Education	3,514
4	Kigali Institute of Sci. &Tech.(KIST)	2,428
5	Universite Libre De Kigali (U.L.K)	11,528
6	Isae - Busogo	2,060
7	NUR	9,350
	TOTAL	**32,450**

Tanzania

	Institution Name	Number of Students
1	DUCE/UDSM Dar es sallam University Col	3,887
2	University of Dodoma	1,547
3	Sokoine University of Agriculture (SUA	3,399
4	Zanzibar University	1,899
5	The State University of Zanzibar	1,383
6	Muhimbili University	2,553
7	Mzumbe University	4,128
8	UDSM	21,266
9	Ardhi university	1,754
	TOTAL	**41,816**

Uganda

	Institution Name	Number of Students
1	Makerere University	38,000
2	Gulu University	3,347
3	Uganda Matyrs University	14,000
4	Makerere Uni. Business school	1,274
5	Uganda Christian University	14,625
6	Islamic University in Uganda	4,000
7	Kyambogo University	11,412
8	Nkumba University	3,500
9	Mbarara Uni. of Sci. and Tech.	2,778
10	Busoga University	2,614
	TOTAL	**95,550**