ICT
A Status Review of ICT in Universities in the SADC Region
Studies Series 2007
by Alex Twinomugisha
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s a r u a
southern african regional universities association
Leading Regional Development through Higher Education
A Status Review of ICT in Universities in the SADC Region

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SARUA is a not-for-profit leadership association of the heads of the public universities in the 14 countries of the SADC Region. Its mission is to promote, strengthen and increase higher education, research and innovation through expanded inter-institutional collaboration and capacity-building initiatives throughout the Region. It promotes universities as major contributors towards building knowledge economies, national and regional socio-economic and cultural development, and for the eradication of poverty.

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The authors are responsible for the choice and the presentation of the facts contained in this document and for the opinions expressed therein, which are not necessarily those of SARUA and do not make any commitment for the Association.
The future of African research and the construction of the Knowledge Society are fundamentally dependent on high quality and affordable ICT.

In this regard SARUA commissioned the current study in order to present a status review of Information Communication Technologies (ICTs) in public universities across the SADC Region.

ICTs have become vital to the overall competitiveness of nations and are therefore critical to Africa’s long-term economic growth. ICTs make possible the fast, efficient and cost effective communication between countries and across continents which underpins the global economy. In addition, high-value ICT products and services themselves form part of an expanding network of international trade and commerce.

Over the past 20 years, ICTs have become an indispensable tool for the delivery and management of Higher Education. Underlying this is the fact that ICTs are ubiquitous in a knowledge society, and cannot be separated from a society’s education and learning systems. Indeed, Higher Education Institutions have a responsibility to ensure that their graduates are competent in the use of ICTs as they enter the world of work.

ICTs form the backbone for science and technology innovation, research and publication. Building a knowledge economy, establishing strong and innovative research communities and centres of excellence, disseminating new knowledge and participating in the global information and research societies are critically dependent on high quality ICTs; much as our economies are dependent on electricity and transport infrastructure.

Examples of innovative and novel ways in which ICTs are being used to improve Higher Education delivery and performance are found in Higher Education Institutions throughout the world. The internet, e-learning, virtual classrooms and learning networks can all be used to expand the quality, accessibility and relevance of Higher Education. ICTs are also being used to develop new education models to deliver a diverse array of learning experiences.

SARUA commissioned this study in order to determine the status of ICT current capacity vs. needs – and anticipated needs – at Higher Education Institutions in the SADC Region. While the study focuses mainly on bandwidth, it also looks at Acceptable Use Policies (AUPs) and the extent to which ICTs are integrated in the operations and teaching functions of universities.

The outcomes of the study include an assessment of the critical constraints and gaps that exist in the ICT infrastructure of Higher Education Institutions, and in the deployment of ICT systems. It also notes that the time is ripe for National Research and Education Networks (NRENs) to emerge and leverage ICT assets such as fibre-optic cable backbones in a strategic and collaborative manner.

SARUA is proud to be part of a process that helps focus the discussion and debate on the role of ICTs in African Higher Education. SARUA is confident that the information and analysis contained in this study will contribute to this process.

Piyush Kotecha
Chief Executive Officer
SARUA

11 March 2008
# TABLE OF CONTENTS

**ACKNOWLEDGEMENTS** .............................................................................................................................. 6
**EXECUTIVE SUMMARY** .............................................................................................................................. 7
1 **BACKGROUND** ......................................................................................................................................... 9
  1.0 Objectives of the Study .............................................................................................................................. 9
  1.1 Methodology ............................................................................................................................................. 9
2 **ICT IN THE UNIVERSITIES** ...................................................................................................................... 10
  2.0 ICT Infrastructure and connectivity ........................................................................................................ 10
    2.0.1 Computers ........................................................................................................................................... 10
    2.0.2 Servers and Server rooms ................................................................................................................... 11
    2.0.3 Campus network .................................................................................................................................. 11
    2.0.4 Internet Access ................................................................................................................................... 11
    2.0.5 Bandwidth Management .................................................................................................................... 14
  2.1 Organization, Leadership and Management of ICTs ................................................................................ 15
    2.1.1 ICT Units ............................................................................................................................................ 15
    2.1.2 Policies and Plans .............................................................................................................................. 15
    2.1.3 Procurement of ICTs ......................................................................................................................... 16
    2.1.4 Donor support .................................................................................................................................... 16
  2.2 Usage of ICTs ............................................................................................................................................ 16
    2.2.1 Internet use ........................................................................................................................................ 16
    2.2.2 Research .......................................................................................................................................... 16
    2.2.3 E-learning ........................................................................................................................................... 17
    2.2.4 Information Management Systems (IMS) ......................................................................................... 17
    2.2.5 Staff and student capacity building ................................................................................................. 19
3 **ANALYSIS OF GAPS AND CONSTRAINTS** .............................................................................................. 20
  3.0 Major ICT challenges ............................................................................................................................... 20
  3.1 Specific constraints and gaps .................................................................................................................. 20
    3.1.1 Student access to computers ............................................................................................................ 21
    3.1.2 Access to a robust, high-capacity campus network ......................................................................... 21
    3.1.3 Inadequate and expensive internet bandwidth ............................................................................ 22
    3.1.4 Bandwidth management .................................................................................................................. 22
    3.1.5 Supporting policies .......................................................................................................................... 23
    3.1.6 ICT Procurement ............................................................................................................................. 23
    3.1.7 Advanced research ........................................................................................................................... 23
    3.1.8 E-learning capacity ........................................................................................................................ 23
  3.2 Extent to which ICTs are integrated into university operations .................................................................. 23
4 **ICTs IN THE SADC REGION** .................................................................................................................... 26
  4.0 ICT Access Indicators ............................................................................................................................. 26
  4.1 Networked Readiness .............................................................................................................................. 26
  4.2 National telecommunication infrastructure ........................................................................................... 27
    4.2.1 Angola ................................................................................................................................................ 29
    4.2.2 Botswana ......................................................................................................................................... 30
    4.2.3 Democratic Republic of Congo (DRC) ......................................................................................... 30
    4.2.4 Madagascar ...................................................................................................................................... 30
    4.2.5 Malawi ............................................................................................................................................ 30
    4.2.6 Mozambique .................................................................................................................................... 31
    4.2.7 Namibia ........................................................................................................................................... 31
4.2.8 South Africa .....................................................................................................................................31
4.2.9 Swaziland .........................................................................................................................................32
4.2.10 Tanzania ........................................................................................................................................32
4.2.11 Zambia ..........................................................................................................................................32
4.2.12 Zimbabwe ......................................................................................................................................33

4.3 Regional and cross-border infrastructure ..........................................................................................34
4.3.1 Planned regional infrastructure projects ........................................................................................34
4.3.2 Alternative infrastructure providers ..............................................................................................35

4.4 International Connectivity ..................................................................................................................38

5 NATIONAL RESEARCH AND EDUCATION NETWORKS (NREN) ..........................................................40
5.0 NREN Development in the SADC region .........................................................................................40
5.1 Challenges to NREN development ..................................................................................................41
5.2 A Regional REN for SADC countries ..............................................................................................41
5.3 Feasibility and design of a regional REN .........................................................................................42

6 STRATEGY AND ROLES OF SARUA .................................................................................................43
6.0 Objectives to be achieved ..................................................................................................................43
6.1 Key considerations for SARUA strategy ..........................................................................................44
6.1.1 Strengths ......................................................................................................................................44
6.1.2 Weaknesses ..................................................................................................................................44
6.1.3 Opportunities ...............................................................................................................................44
6.1.4 Threats .........................................................................................................................................45
6.1.5 Strategy Foundations ..................................................................................................................45
6.2 Roles of SARUA ..................................................................................................................................45
6.3 Work Streams ....................................................................................................................................47
6.3.1 Improve the campus infrastructure of member institutions .......................................................47
6.3.2 ICT organizational structures, management and policies .........................................................48
6.3.3 Creation of a regional REN .........................................................................................................48
6.3.4 Promote institutional collaboration leveraging ICTs .................................................................49

7 CONCLUSION ......................................................................................................................................51

APPENDIX 1 ICT Questionnaire ..............................................................................................................52
APPENDIX 2- ACCESS TO COMPUTING RESOURCES- DETAILS ..........................................................57
APPENDIX 3- CONNECTIVITY DETAILS ...............................................................................................58
Bibliography ..............................................................................................................................................59
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Also my sincere thanks to all those who took the time off to provide information required or to discuss aspects of Information and Communication Technologies (ICTs) in the region and in higher education institutions in the region especially Duncan Martin of Tertiary Education Network (TENET) of South Africa, Heloise Emdon of the International Development Research Centre (IDRC) and Mike Jensen, independent consultant. Thanks also to Karanja Gakio of Cyberplex Africa who supplied me with detailed information from the African Tertiary Institutions Connectivity Survey (ATICS) of 2006.
EXECUTIVE SUMMARY

Information and Communication Technologies (ICTs) have become a necessary and indispensable tool for higher education institutions all over the world. ICT underpins the development of knowledge economies. In the SADC region, universities are actively integrating ICTs into all their operations including administration, teaching, learning and research. There are also several initiatives at the national and regional level to deploy ICT infrastructure and especially telecommunication infrastructure. The time is therefore ripe for an institution like SARUA to play a critical role in advancing its member institutions’ efforts to develop and integrate ICTs at the institutional, national, regional and international levels.

At the institutional or campus level, SARUA’s member institutions are making available computing resources including the Internet to the student and staff bodies. Many of the institutions have deployed campus backbone networks and installed Information Management Systems (IMS). The most interesting development has been noted on the e-learning front. All the institutions responding to a survey conducted as part of the study report have an e-learning initiative or application deployment underway, compared to only about a half of the institutions reporting such initiatives in an earlier survey in 2006. It is important to note that these institutions have in many cases created dedicated ICT management units reporting to the top university management and have also enacted ICT and ICT-related policies.

Despite these efforts, SARUA’s member institutions continue to experience critical constraints and have gaps in their ICT infrastructure and system deployments. Teaching, research and administration staff enjoy much better access to computers than students do, with on average about four teaching staff per computer, three administrative staff per computer and 70 students per computer when considering full-time campus based students. This falls far short of the target of five students per computer as recommended for US universities according to a recent report. Inadequate and expensive bandwidth is still a major challenge. As the African Tertiary Institutions Connectivity Survey (ATICS) found a year ago, the institutions’ bandwidth situation can still be said to be “too little, too expensive and not well managed.” While the average amount of bandwidth per university has gone up compared to a year ago, none of the universities surveyed has close to or over 100 Mbps connectivity. With Gigabit connectivity becoming de rigueur for universities in Europe, the Americas and Asia, SARUA’s member institutions and indeed other African institutions have a long way to go to catch up with their peers elsewhere in the world. Costs of connectivity seem to have gone down by almost 50% compared to a year ago but at about US$2 430 per Mbps, these costs are over 20 times what American and European households enjoy. It is worrying that some universities still do not have ICT policies and only a little over half report having an Acceptable Use Policy (AUP) in place. Indeed, while universities continue to embrace e-learning, only about half of the institutions have developed e-learning policies and provide training for their staff. Enabling policies are necessary for the effective utilization of scarce and expensive ICT resources. Procurement of ICTs at a majority (75%) of the institutions is decentralized to individual departments and some universities operate without any ICT standards to guide acquisition and replacement. This means that universities are probably unable to leverage bulk institutional purchasing power to negotiate lower costs for ICTs. Lastly, there is no evidence of ICTs being used for advanced research. As research is a cornerstone of a university’s activities, this must be brought to the attention of institutional heads.

On the national and regional front, many countries are in the process of developing and deploying national fibre-optic cable backbones. There are also “alternative infrastructure providers” such as electricity companies with substantial fibre assets although the use of these assets is still restricted by regulatory, business and pricing issues. Nevertheless, the time is ripe for National Research and Education Networks (NRENs) to emerge and leverage the increasing availability of these fibre assets. Many countries have few universities and could benefit from a regional rather than, necessarily, a national, Research and Education Network. Already, the Ubuntunet Alliance (UA) has plans to develop a regional REN-like network (the Southern Cluster) and these plans should be supported. SARUA and UA are natural strategic partners that can leverage on each other’s strengths to ensure that a regional REN is developed and deployed collaboratively rather than through possibly two separate initiatives.

Indeed, SARUA has a critical role to play to support its members to overcome some of the capacity constraints and gaps in their endeavors to integrate ICTs into their operations. The overriding goal for SARUA should be to ensure that its members effectively and efficiently integrate ICTs into their operations, without competing with or duplicating their
existing efforts. SARUA’s roles, strategies and activities should, therefore, focus on adding value to its members’ existing and planned efforts, while leveraging its network of members to bring the expertise, knowledge, experience and skills inherent in that network to bear in addressing the challenges they face. SARUA can achieve this by acting as an advocate, facilitator, convener, coordinator and trusted neutral advisor. SARUA is endowed with political capital, by virtue of its membership, with the authority to speak for its members in advancing their causes. One of the biggest contributions SARUA can make to its members’ efforts is to launch an advocacy campaign in support of their members’ efforts at the institutional, national and regional levels. The time is ripe for SARUA’s involvement.
1 BACKGROUND

This study and its resultant report were commissioned by the Southern African Regional Universities Association (SARUA). SARUA’s main stakeholders are the leaders of the 64 public universities in the 14 countries of the Southern Africa Development Community (SADC) of which 45 institutions are currently SARUA members.

1.0 Objectives of the Study

The overall objective of the assignment was to produce an Information and Communication Technology (ICT) strategy document for SARUA that will contain the following:

- A status review of ICT in the universities across the SADC region;
- Status of current capacity vs. needs – and anticipated needs – mainly focusing on bandwidth but to also include Acceptable Use Policies (AUPs) and the extent to which ICT is integrated (or not) into the operations and teaching functions of the universities;
- Recommendations on short/medium/long term strategies to address the major issues identified (including access to and management of any potential additional significant resources).

1.1 Methodology

The assignment was carried out following a three-step process.

Step 1: Discovery
The first step was to identify and gather information on a) the status of ICTs in SARUA’s member institutions b) the status of ICTs especially telecommunication networks at the national and regional levels, and c) existing and planned ICT initiatives at the institutional, national and regional levels. The required information was gathered through searches on the internet, a survey questionnaire sent to all of SARUA’s member institutions, past ICT survey reports/ informal interviews and discussions with key experts and the consultant’s personal contacts. The survey questionnaire was formatted and distributed by SARUA’s staff.

Step 2: Analysis
All the information gathered during the discovery phase was reviewed and an analysis undertaken to determine the current status of ICTs, the needs and gaps that exist and the major challenges faced at the institutional, national and regional levels.

Step 3: Design and Development
The final step involved design and development of strategies based on the needs, gaps and capacity constraints identified during the analytical phase.
2 ICT IN THE UNIVERSITIES

This section outlines the current status of ICTs in SARUA member universities. It examines the state of ICT infrastructure, ICT management and organizational structures and policies and usage of ICT. It draws on information obtained from the ICT survey questionnaires sent to SARUA member universities and on information from the African Tertiary Institutions Connectivity Survey (ATICS) report of 2006.¹

The SARUA ICT survey elicited responses from 12 universities² located in seven countries out of SARUA's 45 member universities in 14 countries in the SADC region. This represents a 26% response rate. The ATICS report of 2006³ had 54 respondent institutions from 27 countries, of which 25 respondents were located in 10 SADC countries.

The ATICS and SARUA survey had four common respondents which will help in making comparisons between the state of ICTs in universities in the region in 2006 and in 2007.

2.0 ICT Infrastructure and connectivity

This section examines the current status of ICT infrastructure and connectivity at SARUA member institutions.

2.0.1 Computers

Computers are a basic ICT device in use at any academic and research institution. Table 1 below shows the minimum, maximum and average user to computer ratios for students, teaching and research staff and non-teaching staff computed from the survey results. The table shows that there are, on average, about 85 students (full time and part time) per computer or 70 full-time on-campus students per computer, while there are close to four teaching or research staff per computer and three non-teaching staff per computer.

<table>
<thead>
<tr>
<th></th>
<th>Student: PC ratio</th>
<th>Student: PC (full time only)</th>
<th>Teaching staff: PC</th>
<th>Non teaching: PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>84.79</td>
<td>69.93</td>
<td>3.51</td>
<td>2.84</td>
</tr>
<tr>
<td>Average excluding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University of Goma</td>
<td>41.12</td>
<td>20.40</td>
<td>1.69</td>
<td>2.21</td>
</tr>
<tr>
<td>Minimum</td>
<td>1.69</td>
<td>1.69</td>
<td>0.30</td>
<td>0.70</td>
</tr>
<tr>
<td>Maximum</td>
<td>565.25</td>
<td>565.25</td>
<td>23.63</td>
<td>9.80</td>
</tr>
</tbody>
</table>

Table 1- Access to PCs

If we exclude the University of Goma which has an extremely low number of computers relative to the student and staff body, then we can see that there are about 20 full-time students per PC, two teaching/research staff per PC and three non teaching staff per PC.

It is clear from the responses that teaching and research staff and administrative staff enjoy more access to computers than students do. The data also suggests that ICTs are being used mainly in the universities’ administrative operations and less in the teaching and learning processes, although this is not conclusive.

¹ See http://aau.org/renu/docs/ATICS2006.pdf for the full report
² There were a total of 14 institutions responding to the survey as University of Malawi had three constituent colleges individually responding to the survey
³ See http://aau.org/renu/docs/ATICS2006.pdf for the full report
2.0.2 Servers and Server rooms

Servers are valuable ICT systems used to share computer resources and to store valuable and confidential information. The number of servers varies widely from institution to institution with one institution reporting no servers at all to a maximum of 180 with an average of one server for every 47 networked computers. While the number of servers in an institution, on its own, is meaningless since capacities of servers and applications being run vary greatly, it nevertheless is an indication of the availability and complexity of computing resources at an institution.

It is good practice to house servers in their own dedicated, secure and air-conditioned rooms and to provide a power backup system to ensure high availability. 83% of the respondents reported having a dedicated server room at their institutions with 92% of the respondents reporting the presence of an air-conditioning system in the server room and 67% of respondents reporting the presence of a power backup system in place for the server room.

2.0.3 Campus network

The campus network is one of the fundamental building blocks of an institution’s ICT infrastructure. As noted by an EDUCAUSE paper on campus networks, the campus network “provides a foundation for teaching, library access, research, administration and myriad university services.”

The campus network is made up of two major parts: a) a high-speed robust backbone linking all the major buildings on campus and responsible for backhauling traffic, and b) Local Area Networks (LANs) in each building.

92% of the respondents report the existence of a campus backbone all of which report having fibre-optic cables deployed as part of the backbone as shown in Table 2. Only five or 42% respondents reported having Gigabit capacity backbones.

Two thirds of the respondents reported the existence of Local Area Network (LANs) in the all the offices and buildings used for teaching and research.

<table>
<thead>
<tr>
<th>With Campus backbone</th>
<th>With fibre in the campus backbone</th>
<th>With copper in the campus backbone</th>
<th>With wireless in the campus backbone</th>
<th>With LANs in all offices and buildings used for teaching and research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of respondents</td>
<td>92%</td>
<td>92%</td>
<td>42%</td>
<td>58%</td>
</tr>
</tbody>
</table>

Table 2- campus networks

2.0.4 Internet Access

All the universities responding to the survey have an internet connection with two of the universities having two or more connections to the Internet.

Internet bandwidth

There was no university reporting total internet bandwidth (uplink and downlink) of more than 100 Mbps and only 33% of the respondents report having a total bandwidth of more than 10 Mbps. (See Table 3 for details).

---

The smallest connection reported is 32/64 Kbps and the largest is 16/16 Mbps. The mean bandwidth capacity is 3.5/4.65 Mbps compared to a mean capacity 0.68/1.32 Mbps reported by the 2006 ATICS survey for the Southern Africa region institutions a year ago. This suggests that universities are purchasing more bandwidth every year. An examination of the four universities responding to both the SARUA and ATICS surveys shows that between 2006 and 2007, all the universities increased their bandwidth, three of them by a factor of 2 or more (see Table 4).

<table>
<thead>
<tr>
<th></th>
<th>ATICS 2006</th>
<th>SARUA 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uplink (Mbps)</td>
<td>Downlink (Mbps)</td>
</tr>
<tr>
<td>University of Zambia</td>
<td>0.512</td>
<td>0.512</td>
</tr>
<tr>
<td>Eduardo Mondlane University</td>
<td>2.5</td>
<td>6</td>
</tr>
<tr>
<td>Sokoine University of Agriculture</td>
<td>0.128</td>
<td>0.256</td>
</tr>
<tr>
<td>University of Malawi (college of nursing)</td>
<td>0.064</td>
<td>0.064</td>
</tr>
</tbody>
</table>

Table 4- Comparison of bandwidth of selected universities between 2006 and 2007

When asked about future bandwidth needs, respondents reported that they planned to increase their bandwidth by an average factor of 50 in the next 5 years and only one respondent reported increasing bandwidth above 1 Gbps.

**Type of connection**

**Figure 1- Type of internet connection**

7% DSL 13% Fibre
20% VSAT
7% Wireless 47% Leased Wire
7% Not Answered

5 See http://aau.org/renu/docs/ATICS2006.pdf for the full report
Almost half of the respondents report using a leased line as their main connection to the internet with only 13% reporting the use of fibre as shown in Figure 1. If bandwidth capacity is to be scaled up significantly (and up to Gigabit level), then all the universities will have to consider using fibre for their internet connection. This is because fibre has a much higher capacity than any of the other methods of connections.

**Type of provider**

Almost half of the respondents report using an NREN or bandwidth consortium as their Internet Service Provider (ISP) while almost a third report using a National Telecom Operator (NTO) as their ISP as shown in Figure 2. It also appears that even those institutions relying on an NREN provider still have to use an NTO’s infrastructure. This suggests that NTOs are natural strategic partners for NRENs and universities. Strategies should therefore be devised to engage these NTOs and the national governments who often own or are shareholders of the NTOs.

![Figure 2- Type of provider](image_url)

**Cost of connectivity**

The average cost of bandwidth for the SARUA survey respondents is US$ 2.43 per kbps. This is lower than the costs reported by the ATICS survey of 2006 a year ago. The ATICS survey reported that the average cost per bandwidth for African higher education institutions was US$ 4.58 per kbps while an analysis of the ATICS survey data for the SADC region institutions reveals an average bandwidth cost of US$ 4.78 per kbps, which is almost the same as the average for the whole continent. Table 5 shows the average, minimum and maximum costs incurred for SADC institutions in 2006 and 2007.

<table>
<thead>
<tr>
<th></th>
<th>SARUA Survey 2007</th>
<th>ATICS 2006 (SADC institutions only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average cost</td>
<td>$2.43</td>
<td>$4.78</td>
</tr>
<tr>
<td>Minimum cost</td>
<td>$0.10</td>
<td>$0.25</td>
</tr>
<tr>
<td>Maximum cost</td>
<td>$5.20</td>
<td>$11.68</td>
</tr>
</tbody>
</table>

Table 5- Cost of connectivity

This suggests that higher education institutions are enjoying much lower (but still high compared to their counterparts in the more developed world) bandwidth costs today compared to a year ago.

---

2.0.5 Bandwidth Management

While 83% of the respondents reported monitoring their internet bandwidth, only half of the respondents report having bandwidth management solutions in place as shown in Table 6 below.

<table>
<thead>
<tr>
<th></th>
<th>Monitor Internet BW</th>
<th>Have Management BW Solutions</th>
<th>Monitor campus Backbone</th>
<th>Scan and block viruses entering network</th>
<th>Have Spam management solution</th>
<th>Have Web cache</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of respondents who</td>
<td>10</td>
<td>6</td>
<td>8</td>
<td>12</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>%age of respondents who</td>
<td>83%</td>
<td>50%</td>
<td>67%</td>
<td>100%</td>
<td>75%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Table 6- Bandwidth management

The ATICS 2006 study also noted that 59% of the respondents did not have any bandwidth management solutions in place.
2.1 Organization, Leadership and Management of ICTs

2.1.1 ICT Units
Almost all the respondents (92%) reported the presence of a dedicated and centralized ICT unit with the head of the unit reporting to top management (Vice Chancellor, Principal or Deputy Vice Chancellor). 33% of the respondents reported that the head of the ICT unit reports to the Vice Chancellor or Principal while the rest reported that the head of the ICT unit reported to a Deputy Vice Chancellor or equivalent. From these findings, it can be inferred that ICTs are gaining prominence within the institutions and that they are increasingly considered as a strategic resource. This is a far cry from a few years ago when ICT units consisted of basement-dwelling technicians usually reporting to the head of the faculty of science or some other related faculty. With the top ICT managers reporting to the uppermost echelons of institutional management and leadership structures, they are in a position to push for change and to mobilize political support and funding for ICT projects.

2.1.2 Policies and Plans
Of the seven policies that respondents were asked to report on, only two respondents reported having all the policies in place while another three reported having no policy at all as shown in Table 7.

<table>
<thead>
<tr>
<th>No of institutions reporting</th>
<th>No Policy</th>
<th>1-3 policies</th>
<th>4-6 policies</th>
<th>All policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of institutions reporting</td>
<td>25%</td>
<td>17%</td>
<td>42%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Table 7- existence of ICT policies and plan

The most frequently enacted policy is an ICT policy and ICT strategic plan with three quarters of the universities reporting the existence of one while only one quarter of the respondents reported the existence of a policy on Free and Open Source Software (FOSS). 42% of the universities responding report having a Bandwidth Management (BWM) policy, 50% a Privacy policy and 58% report having an Acceptable Use Policy (AUP).

<table>
<thead>
<tr>
<th>Type of Policy/ Plan</th>
<th>ICT policy</th>
<th>ICT strategic plan</th>
<th>AUP</th>
<th>Privacy</th>
<th>Security</th>
<th>BWM</th>
<th>FOSS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of respondents reporting policy in place</td>
<td>75%</td>
<td>75%</td>
<td>58%</td>
<td>50%</td>
<td>67%</td>
<td>42%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Table 8- ICT Policies and Plans breakdown
2.1.3 Procurement of ICTs

Only 58% of the respondents reported having developed ICT standards, only 25% follow a centralized approach to IT procurement and 50% have signed a volume licensing agreement or other large scale contract. See Table 9 below for details.

<table>
<thead>
<tr>
<th>No of respondents reporting</th>
<th>Existence of ICT standards</th>
<th>Centralized procurement by centralized IT unit</th>
<th>Decentralized Procurement in consultant with centralized IT unit</th>
<th>IT unit not consulted at all during IT procurement</th>
<th>Volume licensing or other large scale contracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>% of respondents reporting</td>
<td>58%</td>
<td>25%</td>
<td>50%</td>
<td>25%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 9- Details of procurement

2.1.4 Donor support

About 75% of the respondents report having some form of external donor support. Donor support seems to cover infrastructure and systems (PCs, networks, IMS), e-learning systems and content and staff development/training. It is not surprising that donors seem to prefer covering one-time costs only over on-going costs presumably leaving the institutions to cover on-going costs.

2.2 Usage of ICTs

This section examines the current usage of ICT resources at SARUA’s member institutions.

2.2.1 Internet use

All the respondents reported using their internet connection for browsing and email, 92% for research, 25% for Voice over IP (VoIP) and 33% for Videoconferencing (VC). See Table 10 for details.

<table>
<thead>
<tr>
<th>Usage</th>
<th>browsing</th>
<th>VoIP</th>
<th>VC</th>
<th>Email</th>
<th>Research</th>
<th>ELearning</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of respondents reporting usage</td>
<td>12</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>% of respondents reporting usage</td>
<td>100%</td>
<td>25%</td>
<td>33%</td>
<td>100%</td>
<td>92%</td>
<td>58%</td>
</tr>
</tbody>
</table>

Table 10- Usage of Internet access

2.2.2 Research

Even though almost all the respondents reported using the Internet for research, in reality all this research is restricted to browsing for information or accessing online or e-journals. Only one respondent reported using the internet for collaborative research. None of the respondents mentioned using the Internet for such research purposes as accessing distant scientific infrastructure such as supercomputers, modelling and simulation equipment, large astronomical telescopes; remote control of processes; or grid computing.
2.2.3 E-learning

Only 42% of the respondents had an e-learning policy although ALL the respondents had an e-learning initiative underway. Compare this to the 2006 ATICS survey which found that only 39% of the African higher education institutions (and only 32% of SADC institutions) had an e-learning policy or strategy while 47% (SADC institutions only 52%) had an e-learning initiative underway or had installed an e-learning application.

<table>
<thead>
<tr>
<th></th>
<th>SARUA Survey</th>
<th>ATICS 2006 survey (all of Africa)</th>
<th>ATICS 2006 survey (SADC institutions only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>%age of respondents with an e-learning policy/ strategy</td>
<td>42%</td>
<td>39%</td>
<td>32%</td>
</tr>
<tr>
<td>%age of respondents with an e-learning initiative/ application installed</td>
<td>100%</td>
<td>47%</td>
<td>52%</td>
</tr>
</tbody>
</table>

Table 11- Existence of e-learning policy or initiatives

The statistics discussed above and shown in Table 11 suggest that e-learning is increasingly becoming an important element of the use of ICTs at African higher education institutions. Further, it is instructive to note that 58% of the respondents report using the Internet for e-learning (see Table 10) with one respondent actually reporting providing courses to students at home, another running a full diploma course online and another using a blended learning approach for all its courses.

2.2.4 Information Management Systems (IMS)

The majority of the respondents report the existence of one or more IMS or Enterprise Resource Planning (ERP) systems at their institutions as shown in Table 12.

<table>
<thead>
<tr>
<th>No of IMS systems</th>
<th>0</th>
<th>1-2</th>
<th>3-4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of institutions reporting</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>%age of institutions reporting</td>
<td>8%</td>
<td>8%</td>
<td>33%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 12- Existence of IMS

The most common types of IMS systems installed were financial systems and library systems as shown in Table 13.

<table>
<thead>
<tr>
<th>Type of IMS</th>
<th>Student management</th>
<th>Students registration</th>
<th>Finance</th>
<th>Human Resource (HR)</th>
<th>Library</th>
<th>other</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of respondents with</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>8</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>%age of respondents with</td>
<td>75%</td>
<td>75%</td>
<td>83%</td>
<td>67%</td>
<td>83%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Table 13- Institutions reporting an IMS installed

When it comes to system implementation, it appears that a majority of respondents prefer to purchase commercial packages rather than develop a system in-house as shown in Table 1 below. This implementation approach is very similar to American and European universities with an EDUCAUSE 2006 survey reporting that 72.6% of universities purchase a commercial product while 59% develop their own system in-house.

<table>
<thead>
<tr>
<th></th>
<th>Commercial package</th>
<th>In-house development</th>
<th>Not specified</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student management</td>
<td>50%</td>
<td>17%</td>
<td>8%</td>
<td>25%</td>
</tr>
<tr>
<td>Student registration</td>
<td>42%</td>
<td>25%</td>
<td>8%</td>
<td>25%</td>
</tr>
<tr>
<td>Finance</td>
<td>67%</td>
<td>8%</td>
<td>8%</td>
<td>17%</td>
</tr>
<tr>
<td>HR</td>
<td>33%</td>
<td>25%</td>
<td>8%</td>
<td>33%</td>
</tr>
<tr>
<td>Library</td>
<td>75%</td>
<td>0%</td>
<td>8%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Table 14 - System implementation strategies

The most common commercial IMS system reported by the respondents is the Integrated Tertiary Software (ITS) system. ITS claims 18 higher education clients in South Africa and another nine in the SADC region making it a popular choice among universities in the SADC region. Table 15 shows the most common commercial vendor IMS implementations reported. The table includes results from the EDUCAUSE 2006 survey for IMS comparison.

<table>
<thead>
<tr>
<th>Type of IMS</th>
<th>Most common commercial implementation (Number in brackets shows %age of institutions reporting installation)</th>
</tr>
</thead>
</table>
| SARUA       | EDUCAUSE Survey
| Student management | ITS (33%), SARIS (17%), SunGard Higher Education (37.4%), Oracle/ Peoplesoft (15.3%) |
| Students registration | ITS (33%), APIS (8%), APIIS (1) |
| Finance     | ITS (25%), SAGE (17%), SunGard Higher Education (27.9%), Oracle/ Peoplesoft (20.0%) |
| HR          | ITS (25%), Oracle (8%), SunGard Higher Education (25.3%), Oracle/ Peoplesoft (22.0%) |
| Library     | Innovative Interfaces/ Innopac Millennium (25%), Library Solutions (8%), Innovative Interfaces (26.4%), Ex Libris (31.7%) |

Table 15 - Most common commercial IMS implementations

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8 EDUCAUSE. 2006 Core Data Service Fiscal Year 2006 Summary Report, Ch. 5, http://www.educause.edu/apps/coredata/reports/2006/
9 See http://www.its.co.za/newsletter/pages/content.php?cat=Links
2.2.5 Staff and student capacity building

Only about 50% of the respondents report providing any training on e-learning to teaching staff and only 75% report providing ICT training to staff as shown in Table 16. Only half of the respondents report providing IT training to all students.

<table>
<thead>
<tr>
<th>No of respondents reporting to provide</th>
<th>e-learning training to staff</th>
<th>IT training to staff</th>
<th>IT training to all students</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of respondents reporting to provide</td>
<td>6</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>%age of respondents reporting to provide</td>
<td>50%</td>
<td>75%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 16: provision of staff training
3 ANALYSIS OF GAPS AND CONSTRAINTS

This section attempts to determine the major challenges, capacity constraints and gaps in ICT infrastructure, usage and management in SARUA member institutions.

3.0 Major ICT challenges

The SARUA ICT survey questionnaire required member institutions to indicate which challenges they currently face in trying to integrate ICTs into their operations. The results are telling with the major challenges identified relating to lack of funding, attracting and retaining IT staff, capacity of IT staff, inadequate infrastructure, expensive and scarce bandwidth, IT security, ICT leadership and management, alignment of IT to the institutions' needs and cultural and attitude issues among the staff and students.

<table>
<thead>
<tr>
<th>Top 10 issues/ challenges from SARUA survey 2007 (in order of frequency of response)</th>
<th>Top 10 IT issues for higher education 2007 (EDUCAUSE)10</th>
<th>Top 10 Issues for IT industry 2007 (Society for Information Management SIM)11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lack of funding</td>
<td>1. Funding IT</td>
<td>1. Attracting, developing and retaining IT professionals</td>
</tr>
<tr>
<td>2. Attracting and retaining staff</td>
<td>2. Security</td>
<td>2. IT and business alignment</td>
</tr>
<tr>
<td>5. Expensive Bandwidth</td>
<td>5. Disaster Recovery/Business Continuity</td>
<td>5. Improve IT quality</td>
</tr>
<tr>
<td>8. ICT leadership and management</td>
<td>8. Strategic Planning</td>
<td>8. IT strategic planning</td>
</tr>
</tbody>
</table>

Table 17 - Top 10 issues from SARUA survey, EDUCAUSE survey and SIM survey

The most frequently reported challenges relate to lack of funding and attracting and retaining skilled staff. Interestingly, lack of funding is cited by universities around the world as a top challenge as reported by a recent EDUCAUSE survey of higher education institutions12 while attracting and retaining skilled staff is a top challenge faced by the ICT industry as a whole according to a report in Computer World on a recent Society for Information Management (SIM) survey.13 See Table 17 above which shows a comparison of top challenges from the SARUA, EDUCAUSE and SIM surveys.

3.1 Specific constraints and gaps

The areas where gaps exist or where there are capacity constraints in campus infrastructure are detailed below.

---

10 http://www.educause.edu/er/erm07/erm0730.asp
12 http://www.educause.edu/er/erm07/erm0730.asp
3.1.1 Student access to computers

Teaching and administrative staff enjoy much higher access to computers than do students. This is probably not by accident. The use of computers to improve productivity and increase administrative and management efficiency and effectiveness is well known. Research has shown that teaching staff need to have reasonable access to and be familiar and comfortable with technology before they can integrate it effectively into teaching and learning.14 However, in the long run, it is important that students have more access to personal computing resources if they are benefit from the potential of ICTs to improve learning and to facilitate research, communication and collaboration.

At the moment, the universities with an average of about 70 full-time on-campus students per computer (or about 20 if we exclude University of Goma) are far short of achieving the desired goal of having five students per computer.15

Further, a majority of the universities responding to the questionnaire do not have any strategies in place to equip individual staff and students with personal computers.
- Only two (2) universities reported a scheme in place: One university operates a loan scheme and another university has developed a standard policy to issue all teaching and research staff with a computer. Another university reported that it was reviewing a policy to guide such a scheme.
- No university reported a scheme to make computers available to individual students
- Six (6) universities however require graduate level students to own a personal computer.

Institutions need to devise strategies and policies to promote individual ownership of computers for students and staff.

3.1.2 Access to a robust, high-capacity campus network

Only 42% of the respondents report having Gigabit capacities in their campus backbones and 67% of the respondents report having all the buildings used for teaching and research fully networked. Gigabit capacity campus networks should be the norm and not the exception. In addition, member universities need to ensure that they have all their offices and teaching and research buildings fully networked with fast Ethernet and even Gigabit Ethernet. At the very least, every university needs to have a fibre-based backbone.

A recent presentation to African Vice Chancellors recommended that this should be achieved for all universities in Africa by 2008 and that university heads have a big role to play in advocating and making the necessary resources available for this to happen.16

Without a robust, high-capacity and scalable campus network extending to the entire campus, many of the teaching, research and administration services and applications will not be accessible or fully utilized. The campus network can support advanced research even in the absence of good external connectivity. For example, large databases and datasets can be obtained offline (e.g. on high capacity disks or CDROMs) and stored on the network to provide access to researchers and students, high-speed test beds can be developed, large scale simulations and even grid computing applications can be developed and deployed, blended learning and online learning systems can also be developed and deployed and information management systems and other Enterprise Resource Planning (ERP) systems can be widely accessible and beneficially used.

It is important to note that the campus network can become a significant bottleneck to providing quality internet connectivity and to support research networking. As a study on networking in Europe noted, “a major source of limited network performance is at the campus, and this fact must be drawn to the attention of senior management in the university and similar sectors” and that while great advances have been made in building national, regional and international Research and Education Networks (RENs), the campus network is now “often the weakest link in the network.”17 There is need for support to develop Gigabit campus backbones for all SARUA members’ campuses and LANs for all buildings used for administration, teaching and research.

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15 Adam, L. 2007, Campus, National and Regional Research and Education Networks Policy, Regulatory, Infrastructure Process Issues, presentation made at AAU Vice Chancellors Conference, 24 October 2007 in Tripoli, Libya
16 Adam, L. 2007, Campus, National and Regional Research and Education Networks: Policy, Regulatory, Infrastructure Process Issues, presentation made at AAU Vice Chancellors Conference, 24 October 2007 in Tripoli, Libya
3.1.3 Inadequate and expensive internet bandwidth

SARUA member universities still have dismal internet bandwidth capacities. No university has anywhere close to a Gigabit connection to the Internet and almost a quarter of the respondents have internet bandwidth of less than 1 Mbps. In fact, the combined capacity for all the respondents is currently only about 114 Mbps while their peers in Europe and North America increasingly enjoy Gigabit connections as shown in Table 18.

<table>
<thead>
<tr>
<th></th>
<th>SADC universities</th>
<th>Nordic Countries</th>
<th>UK</th>
<th>France</th>
<th>Portugal</th>
</tr>
</thead>
<tbody>
<tr>
<td>%age of institutions with bandwidth &gt; 1 Gbps</td>
<td>0%</td>
<td>100%</td>
<td>About 35%</td>
<td>About 2%</td>
<td>About 25%</td>
</tr>
<tr>
<td>%age of institutions with bandwidth &lt; 1 Mbps</td>
<td>25%</td>
<td>0%</td>
<td>0%</td>
<td>About 21%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Table 18: Comparison of bandwidth capacities for universities in SADC and in selected countries in Europe

When compared to the Nordic region of Europe (Denmark, Sweden, Norway and Netherlands) where ALL the universities have bandwidth in excess of 1 Gbps, it becomes apparent that the bandwidth available to universities in the SADC region is dismal. It is no wonder that two thirds of the respondents reported “expensive bandwidth” and “low bandwidth” as one of the biggest challenges they face (see Section 3.0 above).

If SADC universities are to participate in high-end quality research, they must invest in substantially more bandwidth. The current level of planned bandwidth increase reported for the next five years is not enough. Universities must aim to have Gigabit access at the earliest. As the TERENA 2007 report notes “Gigabit connections can be seen as a necessary, though not necessarily sufficient, condition for a university to engage in high-end research and learning programmes.”

At the very least, every university should strive to attain a minimum bandwidth of 10 Mbps by next year (2008) as recommended to all African Vice Chancellors recently.

The cost of bandwidth, while reducing for all institutions across the board, is still over 20 times that of their peers in the more developed world. Inadequate and expensive bandwidth is also one of the major challenges cited by the respondents. SARUA could play an important role in assisting member institutions to access more bandwidth at lower cost.

3.1.4 Bandwidth management

The solutions to tackling the challenge of inadequate bandwidth must involve increasing available capacity as well as managing existing capacities. As the INASP briefing note on optimizing internet bandwidth in developing country higher education argues, institutions must “recognize that ‘bandwidth’ is a valuable institutional resource or asset that needs to be managed, conserved, and shared as effectively as possible” and that the institutions’ management must “make bandwidth management a priority.”

The ATICS 2006 study also found that the “majority of the respondents (59%) reported that they practiced little or no bandwidth management” and concluded that there was a “critical need for skills training in this vital area.”
3.1.5 Supporting policies

It is worrying that some universities have no ICT policy of any sort (25% of respondents) while many (83% of respondents) do not have all the most important ICT policies in place. The policy arena is certainly one where there is need for support to ensure that all the relevant policies are enacted by all member institutions. Further, having a policy and actually operationalizing that policy are two different things. An ICT audit should be carried out to determine whether the policies enacted are actually being implemented and followed.

3.1.6 ICT Procurement

42% of respondents lack any ICT standards, only 25% have centralized ICT procurement and only half have any volume licensing or large scale contracts in place for ICT.

Standardization and centralized procurement are key strategies for reduction of cost – both direct acquisition costs through leveraging economies of scale and indirect cost such as support, maintenance, repair and training of technical support staff. As universities have identified funding as a major challenge, any strategies to reduce costs and improve value for money are critical.

3.1.7 Advanced research

Only one respondent reported using their internet connection for collaborative research and there is no evidence of using the internet for any advanced research activities or to connect to advanced distant scientific research facilities. The seeming absence of collaborative research or access to distant scientific research infrastructure could be a result of the relatively poor bandwidth of these institutions as well as other constraints. This is an issue that warrants further investigation to understand the precise status of advanced research at member institutions as well as the constraints and challenges faced by researchers at these institutions. Providing adequate bandwidth and ensuring connections to research networks in Europe, Asia and North America is likely to be only part of the solution. Nevertheless, it is an important part of the solution and should be pursued. This is beginning to happen with the creation of NRENs and the efforts of the UbuntuNet Alliance to connect African NRENs to the global research networks such as GEANT.

3.1.8 E-learning capacity

It is evident that e-learning is increasingly taking root in the member institutions with all the respondents reporting to have an e-learning initiative underway. However, it appears that all the efforts are being directed at deployment with only 42% and 50% of respondents reporting having an e-Learning policy and providing training on e-learning to teaching staff respectively. If e-learning efforts are to bear fruit, deployment must be done hand-in-hand with enactment of e-learning policies and training of the teaching staff to enable them use the installed system and develop the necessary content. Students, too, must be equipped with the necessary ICT skills in order to take maximum advantage of e-learning and ICTs. Support in this area is critical as e-learning represents the point at which “the rubber meets the road” when it comes to integration of ICTs into teaching and learning.

3.2 Extent to which ICTs are integrated into university operations

It is difficult to determine the precise extent to which ICTs are integrated into the operations and teaching functions of universities without visiting the institutions and/or interviewing administrators, teaching and research staff and students. However, an attempt can be made to qualitatively gauge the extent to which ICTs are integrated by considering a number of possible indicators. The indicators are based on the assumption that proper integration is largely a result of three key factors:

a) Availability of or adequate access to ICT infrastructure including applications and services: The more users (students, teaching and research staff and administrative staff) have access to computing resources, a robust campus network, adequate bandwidth and ICT applications such as Information Management Systems, the more likely they are to use ICTs in their day-to-day operations and activities. After all it is difficult to integrate anything if one does not have access in the first place.

b) Capacity and know-how of the principal users to integrate and use ICTs: Having access is not enough; users must be equipped with the necessary skills to actually use ICTs in their day-to-day activities and operations.
c) The existence of supporting organizational structures, policies and plans: these must be in place to ensure that ICTs are systematically institutionalized and integrated.

Another important issue to determine is what minimum level of integration (targets) is required and in what time frame this should be achieved. A recent presentation to African Vice Chancellors is very instructive. The presentation outlines the following targets and dates by which they should be achieved:

- **Targets for campus infrastructure**
  - All campuses need to have fibre backbone by 2008
  - Campuses need to achieve student and computer ratio of at least 1:5 by 2010 – US targets
  - Campuses should attain a minimum international bandwidth of 10 Mbits/second Internet connectivity by 2008

- **Targets for content**
  - Meet the content needs of “low level users” by 2008
  - E-learning content for all students by 2009
  - Meet the needs of “higher level users” by 2010
  - Improve bandwidth management, centralized network management and technical capacity
  - Train 500 professionals in e-learning and bandwidth management

- **Targets for NRENs**
  - Establish fully functional NRENs by end of 2008
  - Establish National backbones
  - Connect to any available fiber
  - Lobby for National ICT strategies and broadband strategies to integrate educational needs
  - Reduction of access fees to academic network (differential fees)
  - Put good governance framework in place to benefit from economy of scale
  - Each NREN should strive to obtain at least 1Gbps of bandwidth – only fibre cable can provide this – Take advantage of new fibre cable projects, if fiber exists and lying there try to use it

If these targets are taken as “desirable end states” and collated with the factors outlined above and their corresponding indicators, one can, at a qualitative level, roughly determine the level of integration in SARUA’s member institutions as presented in Table 19 below.

An analysis of the targets and the number of institutions that have achieved these targets shows that roughly half or more of the universities are making progress in creating enabling organizational structures and polices and in building the capacity of users (students and teaching staff). The major challenge for most universities seems to be in the area of providing adequate infrastructure especially enough computing resources and internet bandwidth. This is not a surprise as lack of funding and inadequate infrastructure and facilities were cited among the top 10 challenges faced by these universities.

---

Table 19- Factors that determine extent to which ICTs are integrated

It should also be pointed out that institutions are at different levels of ICT development with some having made advances in integrating ICTs and other still far below meeting the targets. This is a clue to any strategies that SARUA will have to adopt: institutions cannot be treated in the same way because they are at different levels of ICT development and integration. Any strategies will have to be customized and individualized. A good solution is to group or classify institutions according to their level of ICT development and integration and then design solutions that respond to specific classes of universities.
4 ICTs IN THE SADC REGION

This section explores the status of ICTs in the SADC region and focuses on reviewing the existing and planned national level backbone infrastructure for connectivity on a country by country basis as well as existing and planned regional infrastructure. Since research and education networking requires very high speed links that can only be provided by fibre-optic cables, the analysis of the backbone and regional infrastructure developments in the various countries is focused on the development of fibre-optic backbone networks.

4.1 ICT Access Indicators

The countries of the SADC region are all at different levels of ICT development as is clearly shown by Figure 3 which compares the countries’ access to ICTs using three key ICT indicators of access to PCs, Internet and Television (Note: statistics for internet access for Tanzania are not available). The indicators show that Mauritius is generally the most advanced nation in ICT access terms followed by, in no particular order, South Africa, Zimbabwe and Namibia. When compared to Europe, say the United Kingdom with 76.52 PCs, 56.03 Internet users and 110.14 TV sets per 100 inhabitants, it becomes obvious that the SADC region has some way to go to catch up with Europe and North America.

Figure 3- Key ICT indicators for SADC region [Source: ITU ICT Eye 2007- http://www.itu.int/ITU-D/icteye/Default.aspx]

4.1 Networked Readiness

Another indicator of the state of ICTs is the score and global ranking on the Networked Readiness Index, which “measures the propensity for countries to exploit the opportunities offered by information and communications technology”\(^{26}\). The 2006-2007 data\(^{27}\) for the SADC region countries are presented in Table 20 with scores in descending order and show South Africa, Mauritius, Botswana and Namibia with the highest scores in that order.

---


SADC Rank | Global rank | Country      | Global Score
----------|------------|--------------|---------------
1         | 47         | South Africa | 4             
2         | 51         | Mauritius    | 3.97          
3         | 67         | Botswana     | 3.56          
4         | 85         | Namibia      | 3.28          
5         | 91         | Tanzania     | 3.13          
6         | 102        | Madagascar   | 2.95          
7         | 111        | Malawi       | 2.79          
8         | 112        | Zambia       | 2.75          
9         | 115        | Mozambique   | 2.64          
10        | 116        | Lesotho      | 2.61          
11        | 117        | Zimbabwe     | 2.6           
12        | 120        | Angola       | 2.42          

Table 20- Networked Readiness Index for selected SADC region countries

4.2 National telecommunication infrastructure

A few countries in SADC already have extensive telecommunications backbones in place employing a combination of microwave radio relays and fibre-optic cables with other countries in advanced stages of deploying their backbones. Table 21 summarizes the current status of SADC member countries. Some countries have already achieved significant fibre deployments in the backbone network (Mauritius, Namibia and South Africa).

The national backbone networks have traditionally been deployed and owned by the incumbent national telecommunications companies although there are increasingly a number of “alternative infrastructure providers” with extensive fibre and Microwave networks.

<table>
<thead>
<tr>
<th>Country</th>
<th>International fibre</th>
<th>National fibre backbone</th>
<th>Second National Operator (SNO)/ Alternative national operators</th>
<th>Alternative fibre infrastructure providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>SAT3</td>
<td>Under development expected completion 2008</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>No</td>
<td>Yes- covers mostly populated Eastern part of the country</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>DRC</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>
Lesotho  No

Madagascar  SAT3  Under development financed by World Bank

Malawi  No  Under development although ESCOM largest fibre owner with advanced plans to extend network  No  ESCOM

Mauritius  SAFE

Mozambique  No  Large part of network already installed, expect completion by end 2008  TVCABO, EDM

Namibia  No  Yes- very extensive  NAMPOWER

South Africa  SAT3/ SAFE  Yes  Yes  Neotel  Neotel

Swaziland  No  “Ideal” backbone conceptualized  TANESCO, TAZARA

Tanzania  Zamtel reportedly in advanced stages of installing nation-wide backbone.  CECS and ZESCO

Zambia  Zamtel reportedly in advanced stages of installing nation-wide backbone.  CECS and ZESCO

Zimbabwe  TelOne has mainly microwave network. Powertel has fibre and plans to extend network nation-wide  Yes  TELEACCESS  Powertel

Table 21- Summary of connectivity infrastructure in the SADC region

These alternative infrastructure providers include cellular phone companies, power utility companies, owners of gas and petroleum pipelines and railway companies. For example, a recent report\(^\text{28}\) notes that the most extensive terrestrial transmission backbones in many African countries are owned and run by the mobile phone services providers (see Table 22 ) although the backbone links tend to be based on microwave radio.

<table>
<thead>
<tr>
<th>Country</th>
<th>Fixed backbone (km)</th>
<th>Mobile backbone (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRC</td>
<td>500</td>
<td>2 724</td>
</tr>
<tr>
<td>Madagascar</td>
<td>500</td>
<td>2 454</td>
</tr>
<tr>
<td>Malawi</td>
<td>750</td>
<td>1 615</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1 490</td>
<td>1 270</td>
</tr>
<tr>
<td>Tanzania</td>
<td>2 800</td>
<td>8 500</td>
</tr>
<tr>
<td>Zambia</td>
<td>800</td>
<td>1 840</td>
</tr>
</tbody>
</table>

Table 22- Size of terrestrial backbone infrastructure for selected SADC countries

[Source: Options for Terrestrial Connectivity in Africa 20]

While alternative infrastructure providers have established their own telecommunications fibre links, they are in many cases, unable to exploit these links to provide telecommunications services to the public due to licensing restrictions leaving most of the installed fibre “dark”.

Figure 4 below shows the existing and planned fibre network for Africa.

Figure 4- Map showing existing and planned fibre for Africa

A country by country analysis of the state of the national telecommunications backbone follows. The country information has been gleaned from recent reports on telecommunications infrastructure in Africa and various websites on the Internet. The information accuracy has not been verified.

4.2.1 Angola

Angola’s telecommunications network was severely damaged by the civil war; however, several initiatives to develop a national fibre backbone are underway. In late 2006, Angola Telecom embarked on the development of a submarine fibre project called ADONES (Angola Domestic Network System) to connect its coastal provinces and is expected to be completed in 2008. Angola Telecom is also in advanced stages of developing a national terrestrial fibre backbone in partnership with Chinese company ZTE. For international access, Angola relies mainly on SAT3.

4.2.2 Botswana

Botswana already has a highly developed national backbone with fibre available in the more densely populated Eastern part of the country between the major towns of Francistown and Gaborone and run by the state owned incumbent monopoly Botswana Telecom (BT). Botswana Telecom is currently in the process of extending the fibre backbone to other parts of the country and specifically to connect to Namibia in the West via the Caprivi strip and Zambia in the North-North East, which network should be in place by 2009.32

For international connectivity, Botswana has two fibre links of at least 622 Mbps (STM4) to South Africa and radio links to Namibia (PDH), Zambia (SDH of about 622 Mbps) and Zimbabwe (SDH)33. There are also reports that Botswana (together with Namibia) is angling itself to connect to SAT3 via Angola34 once the national fibre network is fully developed.

4.2.3 Democratic Republic of Congo (DRC)

DRC has one of the poorest telecommunications networks in the region with the various wars having destroyed even the little infrastructure that was in place. However, there are reports that DRC is exploring various options to build a network35 although it remains to be seen how far they will go. DRC also has some fibre infrastructure on the railway between Lubumbashi and Lobita and the Western Power Corridor project (Westcor) will also deploy fibre along the proposed power lines from the Inga Falls in the Congo River to Angola, Botswana, Namibia and South Africa.36

Given the size of the country and the general poor state of infrastructure including roads, it is likely that satellite will continue to play a very important role in providing backbone and backhaul links for DRC. A more feasible short term development of fibre might come from the Power Company Société Nationale d’Electricité (SNEL) which is in the process of expanding its transmission network and deploying fibre on its network and through the Western Power Corridor project (Westcor).

4.2.4 Madagascar

Madagascar does not have a national fibre network but recently signed an agreement with the World Bank that will see it benefit from the World Bank’s Regional Connectivity Infrastructure Program (RCIP)37. Under this program, the World Bank will support among other things a) the rollout of a national backbone using a combination of fibre and microwave links b) creation of a virtual landing station and connection to SAFE or another of the proposed East African coast submarine cables and c) bandwidth for targeted users including the education sector. The program particularly mentions the fact that bandwidth for the university sector is aimed at “boosting the use of broadband capacity in universities and technical colleges ahead of and after the arrival of submarine connectivity, and improving inter-university connectivity and traffic generation.”

4.2.5 Malawi

Malawi has one of the poorest connectivity infrastructures in the SADC region. Malawi Telecom, the state owned monopoly telecom company has plans to build a national fibre backbone and is looking at installing a cross border fibre-optic link with Mozambique (between Mwanza in Malawi and Zobue in Mozambique) and a microwave link connecting Lilongwe with Mchinji in Zambia and extending the Mzuzu-Karonga microwave link in northern Malawi to Dar-es-Salaam38. These connections are expected to be in place by the end of 2008.

At the same time, the Electricity Supply Corporation of Malawi (ESCOM) is said to have installed a fibre-optic cable on its power lines between Salima and Kanengo and has advanced plans to install a fibre-optic cable between Lilongwe and Blantyre and between Salima – Mzuzu – Karonga.39 ESCOM plans to eventually have a total fibre network covering 1 280 km from Blantyre to Karonga via Chittheche, Lilongwe to Mchinji in Zambia and Phombeya to Matambo in Mozambique by 2012.40

33 See CEO’s speech to the London Investment Committee http://www.btc.bw/News/default_news.asp
4.2.6 Mozambique

The state owned and monopoly Telecomunicações de Moçambique (TDM) has been rapidly rolling out a national fibre backbone. Work on the backbone reportedly started in 2002 and is expected to be completely in 2008\(^41\). According to reports in Balancing Act Africa, the fibre backbone roll out comprises four phases with three of the phases reportedly complete and operational\(^42\):

- Phase 1 was the deployment of the submarine fibre between Maputo and Beira
- Phase 2 saw the deployment of a fibre link between Beira to Quelimani
- Phase 3 recently saw the commission of a link between Quelimani and Nampula
- Phase 4 is still underway and is expected to extend the network in the north to cover Quissanga, Nacala and Lichinga

Mozambique is expected to have a fully deployed and extensive national backbone in time to connect to any of the proposed submarine cables for the east Africa coast.

The SARUA report on Optical Fibre for NRENs in East and Southern Africa also notes that Mozambique has two alternative fibre infrastructure owners:
- TVCABO, a Cable TV network provider currently owned by TDM and Visabeira, a private company with a fibre network in the capital Maputo
- EDM, the national parastatal power utility company with fibre on its power lines in Maputo and in the Southern part of the country and a 622 Mbps fibre on the Motraco power line interconnecting power stations in Maputo (Mozambique), Komatiport (South Africa) and Edwaleni (Swaziland).

4.2.7 Namibia

Namibia has one of the most advanced telecommunications backbones in Africa with an extensive fibre-optic network developed by the state owned Telekom Namibia, reaching out across the entire country. NAMPOWER, the electricity company also has some fibre on its extensive electricity network.

Namibia connects to South Africa via a fibre link of at least STM4 capacity and onwards to SAT3. Namibia is the only member of the SAT3 consortium without its own landing point, instead relying on transit through South Africa. Namibia is reported to be in advanced talks with Botswana and Angola for Namibia and Botswana to connect to SAT3 via Angola as transit costs through Cape Town have been found to be prohibitive\(^43\). Namibia envisages this connection through an extension of the ADONES from Namibe in Angola to Swakopmund in Namibia.

4.2.8 South Africa

South Africa has the best and most extensive infrastructure in the region. The state owned Telkom South Africa is partially private and recently a Second National Operator (SNO) called Neotel was licensed. Neotel has acquired the fibre infrastructure of alternative infrastructure providers such as the electricity utility company Eskom and the transport parastatal Transnet. For international connectivity, South Africa relies on the SAT3/SAFE cables and now has a minimum of STM-4 (622 Mbps) links with Botswana, Lesotho, Namibia, Mozambique and Swaziland.

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\(^{41}\) http://www.telegeography.com/cu/article.php?article_id=18632
\(^{43}\) http://www.telegeography.com/cu/article.php?article_id=19289
4.2.9 Swaziland

Swaziland has both digital microwave and fibre links to South Africa (from Mbabane to Johannesburg). Swaziland is also party to the Motraco fibre cable linking Mozambique, Swaziland and South Africa which is owned by the power companies of the three countries.

4.2.10 Tanzania

Tanzania also has poor telecommunications infrastructure although the government has unveiled a plan to create an “ideal national backbone” through a multi-stakeholder initiative which will see the “consolidation of segments of the existing and planned Optical Fibre Cable networks from different national utility companies and the incumbent and by bridging the gaps between them.”

Figure 5- “Ideal national backbone” for Tanzania [Source; SARUA fibre report]

An interesting development is that the “incumbent fixed operator TTCL is now part owned by mobile operator Celtel, which also has licences in neighbouring Malawi, Zambia and Kenya, which could ultimately allow Celtel to fuse its networks across the region and build on its national backbone links to the borders.”

4.2.11 Zambia

Zambia’s State owned telecom company, Zambia Telecommunications Company Ltd (ZAMTEL), is reported to be in the advanced stages of installing a fibre-optic backbone around the country. Zambia also boasts two alternative fibre infrastructure providers.

• Copperbelt Energy Corporation (CEC) has over 500 km of fibre-optic on its power grid in the Copperbelt region with all 220 KV sub stations connected to the network at 655 Mbps and all 66 KV substations connected to the network at 155 Mbps.

• Zambia Electricity Supply Company (ZESCO) with fibre running from Katima Mulilo (Western Province) on the Namibian border to Livingstone (Southern Province) bordering Zimbabwe plans to roll out more fibre across its entire network. The ZESCO planned fibre network is shown in Figure 6.

Zambia being landlocked relies on satellite for most of its international traffic. It has an STM4 link to Botswana over SDH digital radio and an analogue PDH link to Tanzania. Zambia could easily link up to Namibia through a short fibre interlink since there is fibre up to the common border on both sides (Telecom Namibia and ZESCO).

4.2.12 Zimbabwe

Zimbabwe’s fixed line entity TelOne has an extensive microwave radio based backbone network. The largest fibre owner is Powertel, a wholly own subsidiary of Zimbabwe Electricity Supply Authority (ZESA) which “is a licensed Public Data Service Provider in Zimbabwe, with over 1 000 kilometres of optical fibre cable in operation countrywide, having a backbone capacity of STM 4”[47]. The existing network runs from Harare to Bulawayo in the South of the country with plans to deploy an eastern circuit covering Mutare and Masvingo as shown in Figure 7. Powertel is reportedly already leasing capacity to the Zimbabwean incumbent TelOne, and has submitted a bid to apply for a fixed-line licence.[48]

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[47] http://www.powertel.co.zw/inside.cfm?pid=1
Zimbabwe being landlocked has mostly relied on satellite for its international traffic but is reported to have recently concluded an agreement with Telkom South Africa which led to the installation of an STM1 digital radio link from Gweru on the Zimbabwe side and a fibre link on the South African side. The connection to Botswana is via an SDH radio link. However, it is possible to construct a short fibre interconnect between Botswana and Zimbabwe as both Powertel on the Zimbabwe side and Botswana Telecom on the Botswana side have fibre to the common border:

![Infrastructure Development](image)

Figure 7- Powertel fibre network [Source: Powertel website](http://www.powertel.co.zw/infrastructure.html)

### 4.3 Regional and cross-border infrastructure

The SADC region boasts of several countries that already have high-speed inter-connected telecommunications infrastructure with plans to develop a fully-fledged regional telecommunications network. Table 23 below shows the existing and planned cross-border connections.

#### 4.3.1 Planned regional infrastructure projects

There are three noteworthy projects to develop a regional network and upgrade cross-border connections in the SADC region as noted by the NEPAD eAfrica Commission report on Backbone telecommunications infrastructure development initiatives in Southern and East Africa:

49 [http://www.powertel.co.zw/infrastructure.html](http://www.powertel.co.zw/infrastructure.html)

• The COMTEL Company comprising national telecom operators of the COMESA region and other investors, which envisages providing advanced voice and data services over regional telecommunications infrastructure and linking to upstream intercontinental bandwidth via South Africa and Egypt or Djibouti, and through the EASSY system when it is built.
• The SADC Regional Information Infrastructure (SRII), which a process undertaken by the NTOs in the SADC countries to build and upgrade their national infrastructure and cross-border telecommunication to ensure a robust, meshed broadband network linking the countries in the region.
• The COM-7 project, which in its first phase aims to provide a link from Livingstone (Zambia) to Dar es Salaam (Tanzania), with a branch to Lubumbashi, using railway and power

4.3.2 Alternative infrastructure providers

There are two regional alternative infrastructure providers with substantial fibre assets worth exploring in some more detail. These are Motraco and the Southern African Power Pool (SAPP).

Motraco

This is a joint venture company owned by the three power companies of South Africa (Eskom), Swaziland (Swaziland Electricity Board- SEB) and Mozambique (Electricidade de Mocambique EDM). The company was established to provide power from South Africa to the Mozal aluminium smelter in Mozambique. The company has installed a 622 Mbps fibre cable linking Maputo, Mbabane and Johannesburg on the power lines of the three shareholders.51

<table>
<thead>
<tr>
<th>Country</th>
<th>Existing regional connections</th>
<th>Planned regional connections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td></td>
<td>Talks underway with Namibia and Botswana for fibre connections</td>
</tr>
</tbody>
</table>
| Botswana| • STM1 (155 Mbps) digital microwave to Namibia  
• Two fibre connections greater than STM4 (622 Mbps) to South Africa  
• SDH radio to Zambia and Zimbabwe | • Talks with Angola and Namibia to connect to SAT3 via Angola.  
• BTC currently extending fibre backbone to connect to Namibia and Zambia  
• Short fibre interconnect between Zimbabwe (Powertel) and BTC as both have fibre to the border |
| DRC     |                              | Connections to Angola and Zambia could be made via the SAPP network |
| Lesotho | STM4 (622 Mbps) microwave links to South Africa | Plans underway to connect to SAFE and to Mozambique via EASSY cable |
| Madagascar |                          | Plans underway to connect to SAFE and to Mozambique via EASSY cable |
| Malawi  | • Panafell 34 Mbps PDH microwave link to Tanzania  
• 34 Mbps PDH link to Zimbabwe | • COM 7/ SRII projects to build fibre link Tanzania and Zambia  
• SRII short term plans to build 155 Mbps  
• SDH microwave link; medium term plan to 622 Mbps SDH fibre system to Zimbabwe  
• Malawi- Zambia proposed SRII/ Comtel link  
• Malawi-Mozambique- proposed Comtel link using SAPP network |

51 See http://www.motraco.co.mz/index.php?option=com_content&task=view&id=26&Itemid=41
### Table 23- Regional cross border connections

<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
</table>
| Mozambique       | • 34 Mbps PDH microwave link to Zimbabwe  
                  • Digital Microwave links to Swaziland and South Africa  
                  • 622Mbps fibre link via Motraco on to Swaziland and South Africa  
                  • SRII Long term plan for fibre link from Beira in Mozambique to Harare via Mutare |
| Namibia          | • Namibia- Botswana- See Botswana  
                  • STM4 Plus fibre link to South Africa  
                  • Namibia- Zambia- ZESCO has fibre running from Katima Mulilo on the Namibian border to Livingstone on the Zimbabwean border.  
                  • Namibia- Angola- See Angola |
| South Africa     | South Africa has a minimum of STM-4 (622 Mbps) links with Botswana, Lesotho, Namibia, Mozambique and Swaziland. |
| Swaziland        | STM4 Links with South Africa and Mozambique via Motraco fibre and SDH Microwave links to South Africa and Mozambique |
| Tanzania         | • Analogue Panaftel link to Zambia  
                  • Tanzania-Malawi (see Malawi) |
| Zambia           | • Analogue UHF radio link to Zimbabwe  
                  • Zambia- Botswana- see Botswana  
                  • Zambia- Namibia- See Namibia  
                  • SRII plan to upgrade to fibre Zambia-Zimbabwe link from Livingstone to Gweru |
| Zimbabwe         | • See Zimbabwe neighbours above  
                  • See Zimbabwe neighbours above |

### Southern African Power Pool (SAPP)

SAPP is a common market for electricity for the mainland SADC countries. The creation of the SAPP has meant that most of the mainland countries in the SADC now have inter-connected Power Grids with the exception of Tanzania, Angola and Malawi although there are plans underway to connect the grids of these countries to the SAPP. For Angola, connection will be achieved via the NEPAD’s Western Power Corridor Project (Westcor) a joint venture involving the national power utilities of Angola, Botswana, the Democratic Republic of Congo (DRC), Namibia and South Africa. Malawi will connect through the World Bank supported Mozambique–Malawi interconnector project and Tanzania through the Tanzania-Zambia-Kenya interconnector project. More importantly, most of the national electricity companies in the SAPP already have substantial fibre cable strung on their transmission grids and a few (Zimbabwe’s ZESA and Zambia’s Zesco) are reportedly already selling their fibre capacity.

SAPP also has a telecommunications project that is aimed at linking the three control areas; Eskom (South Africa), ZESA (Zimbabwe) and ZESCO (Zambia) via a VSAT link in the short term and fibre-optic in the long-term supported by the World Bank. According to the SAPP July 2007 monthly report, the VSAT network is now in place and operational.

The SAPP electricity network is of considerable interest in the development of a regional fibre network as it has an extensive electricity transmission network (see Figure 8) and many of its members already have or are planning to deploy fibre cables.
on their transmission network. In fact, recently, Balancing Act Africa reported that a company called African Dark Fibre Communications Ltd is in “advanced stage of negotiation with the South African Power Pool companies to lay fibre to connect the member countries” and recently issued calls for expressions of interest from contractors. The company hopes to start by inter-connecting the fibre networks of South Africa’s Eskom, Zimbabwe’s ZESA and Zambia’s Zesco.

Figure 8: SAPP existing and planned network [Source SAPP website]

Despite the existence of these alternative infrastructure providers with trans-border fibre, the use of their infrastructure is still very limited due to a multitude of regulatory, policy, business and pricing issues. The fact that the infrastructure is owned by different operations in separate national jurisdictions does not help matters. The SARUA study on Optical Fibre for Education and Research Networks in Eastern and Southern Africa provides concrete examples of the challenges of using existing regional infrastructure and presents test cases. The report notes that although inter-country fibre links may exist, they exist only “in principle” and their use is subject to many challenges, “not only the regulatory issues but also business models and pricing.”

54 SAPP July 2007 Monthly report, http://www.sapp.co.zw/viewinfo.cfm?id=60&linkid=2&siteid=1
56 See http://www.sapp.co.zw/viewinfo.cfm?id=52&linkid=7&siteid=1
4.4 International Connectivity

Of the 14 SADC countries, only three (Angola, South Africa and Mauritius) have access to international fibre through the SAT3/SAFE cable system and most countries’ international bandwidth is still below 100 Mbps.

The total international bandwidth available to these countries is dismal when compared say to Europe, Asia or North America. For example, in 2005 (the year for which statistics are based) the United Kingdom was reported to have a total international bandwidth of over 780 Gbps\(^58\). Some of the major factors responsible for this low international bandwidth in the SADC region are:

- Some of the countries in the region are landlocked (6 out of 14) without the possibility of direct connection to submarine fibre. Many of these countries rely on expensive satellite links for their international traffic and are unable to afford or access high bandwidth links.
- There are few countries with an extensive and high-speed backbone and access network to reach out to many users. This situation creates an artificially "low" demand for bandwidth.
- Even where an extensive broadband-capable backbone and access network exist, such as in South Africa and Namibia, the prices of high-speed connectivity are still too high and way beyond the affordability of the masses. This factor also contributes to an artificially low demand for international bandwidth. The mentality of most telecommunications providers in Africa is one of low-volume-high margin rather than high-volume-low margins.

Another interesting way to look at the bandwidth available per country is to consider the bandwidth available per internet user as show in Figure 10. In fact, this is probably a more relevant way of looking at the bandwidth availability, as having the

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\(^{57}\) Optical Fibre for Education and Research Networks in Eastern and Southern Africa, SARUA, 2006 http://www.sarua.org/web/guest/publications

\(^{58}\) ITU statistics
largest amount of bandwidth does not necessarily mean that users have access to high capacity bandwidth. As evidenced by the graph, South Africa with the highest total amount of Internet bandwidth, happens to have one of the lowest bandwidth per internet user in the region.

![Internet bandwidth per internet user](image)

Figure 10- International bandwidth per internet user
5 NATIONAL RESEARCH AND EDUCATION NETWORKS (NRENS)

National Research and Education Networks (NRENS) are human and telecommunications networks and their associated organizational structures whose aim is to promote and advance continuous communication, collaboration, knowledge creation and knowledge exchange in the education and research sector for the benefit of social and economic development. NREN creation is driven mainly by the need to obtain cheaper and more bandwidth and the need to share expensive research facilities. Both these drivers are at play in the SADC region.

5.0 NREN Development in the SADC region

The SADC region boasts of two functional60 NRENS: South Africa’s Tertiary Education Network (TENET) and the Malawi Research and Education Network (MAREN). TENET also connects universities in Lesotho and Swaziland.

The remaining countries are in various stages of developing their own NRENS with the most advanced in their plans being Mozambique (MoRNET), Namibia (XNET/EDUNET) and Zimbabwe (ZARNet). Nascent efforts exist in Zambia (ZAMNET), Tanzania (TENET) and DRC. Table 24 shows the status of current NREN development in the SADC region.

South Africa’s TENET is more of a “procurement consortium”61 although it has started directly promoting research networking by connecting its member institutions to GEANT. Recently, there have been efforts to create a parallel research and education network, South African National Research Network (SANReN), by the South African Department of Science and Technology which was largely seen as a duplication of TENET’s efforts. Recent reports indicate that SANReN will collaborate with and utilize TENET’s infrastructure.

The Malawian NREN is a VSAT based NREN that currently has two founding members: the University of Malawi and Mzuzu University and “two other institutions are in process of joining; National College of Information Technology (NACIT), a tertiary institution; and the Department of Agricultural Research, a research institution.”61

<table>
<thead>
<tr>
<th>Country</th>
<th>Operational NREN</th>
<th>NREN under development</th>
<th>Name of NREN/ Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td></td>
<td>No information</td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td></td>
<td>No information</td>
<td></td>
</tr>
<tr>
<td>DRC</td>
<td></td>
<td>x</td>
<td>DRC REN in very early stages of formation</td>
</tr>
<tr>
<td>Lesotho</td>
<td></td>
<td></td>
<td>Universities connected by South Africa’s TENET</td>
</tr>
<tr>
<td>Madagascar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malawi</td>
<td>x</td>
<td></td>
<td>MAREN- VSAT based REN</td>
</tr>
<tr>
<td>Mauritius</td>
<td></td>
<td></td>
<td>No information</td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td>x</td>
<td>MoRNet</td>
</tr>
<tr>
<td>Namibia</td>
<td></td>
<td>x</td>
<td>An educational ISP called EDUNET being created under the XNET initiative</td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td>x</td>
<td>TENET- Most developed NREN. But also SANReN under development</td>
</tr>
<tr>
<td>Swaziland</td>
<td></td>
<td></td>
<td>Universities connected by TENET</td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td>x</td>
<td>TENET</td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td>x</td>
<td>ZAMREN</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td></td>
<td>x</td>
<td>ETNZ (Education and Tertiary Network of Zimbabwe)</td>
</tr>
</tbody>
</table>

Table 24- Status of NREN development in the SADC region

59 Defined as having deployed a physical telecommunications infrastructure and/or providing Internet access for their members
60 SARUA report on optic fibre for NRENS in East and Southern Africa
61 Source: http://www.malico.mw/maren/
5.2 A Regional REN for SADC countries

The particular challenge faced by countries with few university level institutions could be tackled through two strategies:

a) Developing an NREN for all educational institutions in the country – an approach taken by countries like Namibia through the XNET initiative.

b) The aggregation of bandwidth and sharing of resources at the regional rather than the national level. This will call for the creation of a regional Research and Education Network (REN).

Countries with very few university level institutions (less than 10) include: Botswana (1), Lesotho (1), Malawi (2), Mauritius (7), Mozambique (6), Namibia (2), Swaziland (1), Zambia (3) and Zimbabwe (9) although it should be noted that some institutions have multiple “constituent” colleges or schools geographically dispersed around the country. For some of these countries, a regional REN should be a natural choice.

Such a regional REN would also enable institutions in the SADC region to establish and share links to other global RENs such as GEANT and Abilene rather than establish multiple independent links. A regional REN would also promote regional research collaboration. As the SADC Regional Indicative Plan notes, “there is very little cooperation in science and technology between countries in the region” mainly because of “the absence of a dedicated regional structure to drive regional cooperation”.

By comparison, the efforts to create NRENs in the rest of sub-Saharan Africa are still in the early stages without a single functional NREN in any of the other sub-Saharan countries outside the SADC region except for Kenya’s KENET. North Africa on the other hand has well developed NRENs, with every country in that region boasting of a well developed and functional NREN thanks in large measure to the support provided by their governments in building or accessing low cost national telecommunications networks, and support from the European Commission and GEANT as part of the EUMEDCONNECT project.

An interesting development is the creation of the UbuntuNet Alliance (UA) which aims to establish itself as the Research and Education Network for the whole of Africa with a vision to provide “very high speed - gigabits (Gb/s) connectivity instead of the current kilobits (kb/s) between African Universities and Research Institutions.” UA has also established a hub in London to allow for peering with other RENs. Section 6.3.3 discusses possible collaboration with the UbuntuNet Alliance.

5.1 Challenges to NREN development

The low level of NREN development in the region and in sub-Saharan Africa in general can be attributed to a number of challenges that vary from country to country:

a) Lack of understanding or awareness of the benefits of ICTs in general and the benefits of a collaborative approach to ICT acquisition and maintenance.

b) Lack of capacity to plan, design and implement the NREN

c) Lack of funding to develop, run and maintain the NREN

d) Very few universities and research institutions in the country, which means that the investment required to set up NREN structures and infrastructure is too high. This typically is a situation found in countries with low populations or in very poor countries.

The SARUA report on Optical Fibre for NRENs in the East and Southern region also supported creation of a regional REN noting that: “NRENs would be peering via a regional broadband academic backbone to share resources and support trans-border research and education. The regional backbone would also offer peering via the global academic backbones, such as Internet2 [Internet2], Géant, Eumednet, Alice, Tein [DANTE], and others, to share global resources, as well as transit to the Internet.”

62 http://www.ubuntu.net/
63 Data from International Association of Universities, 2005, http://www.unesco.org/iau/onlinedatabases/list.html
64 http://www.sadc.int/key_documents/risdp/chapter3.php
5.3 Feasibility and design of a regional REN

The existence of several countries with inter-connected telecommunications infrastructure and concrete plans to develop a fully-fledged regional telecommunications network for the region, as detailed in section 4.3 makes a regional REN feasible. The section that follows explores a possible design for a regional REN.

The envisaged regional REN could be developed in a phased manner:

Phase 1
All the countries with a common border with South Africa (Botswana, Namibia, Zimbabwe, Lesotho, Swaziland and Mozambique) currently have existing high capacity (STM 1 or greater) connectivity with South Africa and all of them have fibre connections to South Africa of one form or another with the possible exception of Zimbabwe (although there is an STM4 digital radio link to the border on the Zimbabwe side and fibre on the South African side).

It is therefore possible for universities in these countries to inter-connect to each other through their national NRENs and to the existing fibre SAT3/SAFE cable in South Africa fairly easily. Angola with access to SAT 3 and Mauritius with access to SAFE could also connect to these countries via the UbuntuNet Alliance’s hub in London or a virtual hub established in Johannesburg or Cape Town.

Tanzania, DRC and Madagascar could be brought into the network using VSAT. In fact, institutions in these countries could take advantage of the low prices of VSAT negotiated by the Partnership for Higher Education (PHEA) consortium and the planned cooperation of the bandwidth consortium and UA to develop the consortium as a VSAT REN or VREN. This could be done as part of phase 1 or phase 2.

Phase 2
The next phase could be to connect Zambia through Namibia or Botswana and Malawi through Zambia or Mozambique via fibre especially now that Zambia and Mozambique are in very advanced stages of deploying their nation-wide fibre backbones.

Phase 3
Phase 3 could involve the connection of Tanzania and Madagascar once the East African coast fibre becomes a reality through one or more of the current competing initiatives underway. Table 25 summarizes the phased evolution of the regional REN.

<table>
<thead>
<tr>
<th>Phase 1 connections fibre (Short term 3-6 months)</th>
<th>Phase 2 connections (Medium term 6-12 months)</th>
<th>Phase 3 connection 12-24 months</th>
<th>Phase 1 or 2 connections VSAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Botswana to SA</td>
<td>• Zambia- via Namibia or Botswana</td>
<td>• Tanzania via EASSY/SEACOM or via Mozambique</td>
<td>• Tanzania</td>
</tr>
<tr>
<td>• Namibia to SA</td>
<td>• Malawi- via Zambia or Mozambique</td>
<td>• Madagascar via SAFE65</td>
<td>• Madagascar</td>
</tr>
<tr>
<td>• Zimbabwe to SA</td>
<td></td>
<td></td>
<td>• DRC</td>
</tr>
<tr>
<td>• Lesotho to SA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Swaziland to SA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mozambique to SA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Zimbabwe to SA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Angola via SAT 3 to UA Hub</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mauritius via SAFE to UA Hub</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 25- Evolution of a regional REN

65 On-going project financed by the World Bank
6 STRATEGY AND ROLES OF SARUA

An important element of such a regional REN would be a “hub” or “peering point(s)” to which institutions in the various countries would connect. The most likely location of such a hub would be South Africa or the UA Hub already established in London.

South Africa should be a preferred hub given that:

a) Six countries border South Africa and have existing high capacity circuits with South Africa
b) South Africa has a well developed telecom infrastructure - better developed than any of the other countries and is therefore able to provide reliable and high capacity backhaul links,

c) South Africa is the only country in the region that will have access to more than one cable (it already has access to two) allowing for restoration in case of submarine cable failure on any route and efficient routing of traffic to Europe, the US and Asia.
d) Further more, using the UA Hub in London will mean paying for regional traffic to transit all the way to London.
e) Over 40% of SARUA's member institutions are found in South Africa and South Africa also happens to have a well developed NREN which would facilitate linkage with other universities in the region.

Institutions connected by VSAT could use the London UA Hub in the short to medium term.

Once the regional telecommunications network is fully developed and once the East African coast has realized fibre, the regional REN could also have Mozambique and Angola as backup gateways to international fibre. Section 6.3.3 explores a strategy to develop the regional REN.

From a review of the status of ICTs in the SARUA member universities in Section 2, it is evident that these universities are actively pursuing the integration of ICTs in their operations and that they are faced with capacity constraints. There is no doubt that these institutions could benefit from support and assistance. This section seeks to outline how SARUA could lend such needed support and assistance and the precise nature of such assistance. The approach to strategy definition follows three steps:

a) Needs Analysis: it is important to establish whether there exists a need for SARUA to lend support in the ICT arena. Any successful strategy will need to be demand-driven. Needs are identified through an analysis of the challenges faced by member institutions, their capacity constraints and existing gaps. A needs analysis has already been conducted in section 3.

b) Design: This step explores the issues that should be taken into account in designing any strategy and roles for SARUA.

c) Development: This step examines and documents the strategies that SARUA should adopt, the roles it should play and some of the activities that it should consider undertaking.

6.0 Objectives to be achieved

As the SARUA Strategic Plan notes, “ICT forms the backbone for science and technology innovation, research and communication and the development of the knowledge society for the region” 66. If this potential is to be realized, then SARUA’s member institutions must integrate ICTs into their operations.

The overriding objective for SARUA in the ICT arena should be to assist and support its member institutions to integrate ICTs into their administration, teaching, learning and research operations with a view to:

a) strengthening management and decision making processes
b) improving and strengthening teaching and learning
c) promote inter-institutional collaboration on education and research

Realization of this objective will involve tackling the three factors necessary for successful integration:

1. access to adequate infrastructure and systems,
2. capacity of users; and
3. enabling organizational structures and policies.
6.1 Key considerations for SARUA strategy

Before delving into the definition of strategies and roles, it is important to consider the readiness, capacity and limitation of SARUA as an organization and the external environment in which it will have to operate in relation to its objectives. Such a consideration will identify important issues that will affect the successful execution of any strategy. The best way to identify these issues is by undertaking a SWOT analysis—Strengths, Weaknesses, Opportunities and Threats for the specific area of ICTs.

6.1.1 Strengths

SARUA draws its strength from the fact that it has a mandate from the highest levels of its member institutions: the Vice Chancellors, Rectors, Principals and other heads of member institutions. This mandate translates into definite and tangible support for its activities. In business parlance, this unique strength is SARUA’s “competitive advantage.” Heads of university level institutions are usually endowed with good “political” connections, and therefore the support that SARUA will bring to bear is likely to be of a more political nature.

SARUA’s other major strength is that its creation has been preceded by an acknowledgement by the SADC political entity of the necessity to create such an entity as SARUA. While SARUA has been “independently established” it, nevertheless, benefits from such acknowledgment giving SARUA some measure of influence at the highest levels of the regional political entity. That is SADC. SARUA can use this influence to lead advocacy for issues dear to its members at the regional level.

Finally, SARUA should draw strength from its network of members. This network is a highly potent reservoir of talent, expertise, skills, experience and knowledge that should be leveraged for the collective good of the network. This may involve peering weak and strong (in terms of ICT resources) institutions to exchange ideas and identifying experts within the network who could be used as resources persons to assist members in need. As much as is possible, SARUA should encourage sharing/exchange of skills, knowledge and expertise within the network while leveraging external knowledge and expertise where none exists internally.

6.1.2 Weaknesses

SARUA’s weaknesses stem from the fact that it is a relatively small new organization with a small skilled staff and finite resources in a world where its members have many capacity constraints and ICT resources are meagre. This suggests that SARUA carefully concentrates its finite financial and human resources on activities that maximize its abilities while leveraging its strengths.

Another weakness is that SARUA is not an ICT-focused organization and therefore is not likely to have the technical skills in-house to directly address ICT challenges. This suggests that SARUA should not get directly involved with any activities involving implementation of ICT infrastructure and systems or operations. Rather, it should restrict its self to activities that draw directly upon its strengths: value-adding activities involving providing strategic advice, facilitation, convention, coordination and advocacy. This view is supported by the results of the survey with respondents mainly supporting roles related to the value adding activities as shown in Table 26. Implementation should be left to its member institutions and other national and regional entities.

Lastly, SARUA being a relatively new institution, moreover one, whose major focus is not on ICTs, might have some credibility issues in the area of ICTs with some of its members. These issues should be resolved over time, as SARUA begins to execute its strategies and as members begin to see tangible results from SARUA’s intervention. This necessitates identification and delivery of some “early wins” to build its members’ confidence in its ability to deliver real value.

6.1.3 Opportunities

All of SARUA’s members are actively embracing ICTs and are involved in a whole range of institutional, national and regional initiatives to integrate and leverage ICTs in and for their operations. This means that SARUA can focus its activities and resources on activities that improve efficiency and effectiveness of the use of ICTs rather than on the more basic promotion of ICTs per se as might have been the case a few years ago. These member institutions, despite their best efforts, are also faced with some constraints. This means that the environment is ripe for supportive and assistive interventions.

6.1.4 Threats

It should be realized that many member institutions are actively trying to tackle the challenges they face through institutional, national and regional initiatives. This situation could lead to some of SARUA’s actions being seen as duplication or potentially competitive. SARUA should therefore adopt a strategy that identifies existing and emerging efforts and aims to promote, advance and accelerate these efforts where appropriate.

Another threat stems from the fact that SARUA could be perceived as a South African driven organization through no fault of its own. For one, its membership is almost 40% South African and it is based in South Africa. The South African members of SARUA also happen to be the most advanced in terms of access to ICT resources and connectivity, and therefore any strategies and activities it embarks on could be perceived as South African driven with a potential to alienate the other members. These perceptions can be avoided or minimized by ensuring maximum transparency in its activities, inclusiveness in its strategies, and by being seen to engage all its members objectively.

Finally, SARUA’s members face many constraints at the institutional (campus), national (NRENs) and regional levels and it is tempting for SARUA to try and address the constraints at all levels. This could lead to the failure of SARUA’s strategy and damage to its credibility through over-extension of its resources. Any successful strategy must involve focus. Universities care, first and foremost, about what is happening in their own institutions. Further, if ICTs are to play a transformational role in higher education and to fulfill their potential as a “backbone for science and technology innovation, research and communication, and the development of the knowledge economy”\(^{68}\) then a bottom-up approach rather than a top-down approach must be emphasized. If the potential of ICTs can be demonstrated and realized at the institutional level, then university heads will be more inclined to participate in and invest in building national and international ICT education and research infrastructure. This therefore calls for SARUA to focus its support at the institutional level.

6.1.5 Strategy Foundations

A successful strategy should leverage an organization’s strengths, seek to maximize and exploit opportunities, overcome weaknesses and minimize threats. From the strategic analysis above, it is clear that any successful strategy for SARUA should:

- Involve mobilization and leveraging political support to promote the development and advancement of ICTs at the institutional and regional level.
- Focus on value-adding activities involving providing strategic advice, facilitation, convention, coordination and advocacy; avoid taking on implementation activities.
- Identify and execute some “early wins”.
- Avoid any activities that appear to be competing with or duplicating existing member initiatives.
- Leverage the knowledge and expertise of members in its network.

6.2 Roles of SARUA

From the strategic analysis above, the following roles could be defined for SARUA:

1) Advocate
SARUA should leverage its political capital to sensitize and advocate to the heads of its member institutions to invest human and financial resources in developing and advancing their institutional and regional ICT infrastructure. SARUA should also launch an advocacy campaign aimed at national government and regional political and regulatory structures. SARUA should be at the forefront of championing its members’ interests in the ICT arena.

2) Convener
SARUA should mobilize its members and provide a forum for them to share experiences, jointly tackle challenges and coordinate activities.

3) Coordinator
SARUA should seek to identify opportunities where member institutions might be duplicating initiatives or where they would most benefit from collaboration and seek to assist its members to align their plans, activities and initiatives. A coordination role will also require that SARUA constantly interacts with its members and keeps abreast of developments at the institutional and regional levels. Coordination will also involve supporting member universities to develop strategic plans.

\(^{68}\) SARUA Strategic Implementation Plan 2007-2012
4) Facilitator
SARUA should be involved in supporting member institutions develop ICT policies, strategic plans and work plans. SARUA could also identify and leverage external resources and expertise for its members benefit in this regard.

5) Advisor
SARUA should provide strategic advice on ICT issues especially to the senior management of its member institutions.

These roles are also reflected in the survey responses on the proposed roles for SARUA. Table 26 summarizes the responses to a number of roles that were put to member institutions. 75% of the respondents indicated that they would like SARUA to provide strategic advice. Two thirds of the respondents also indicated that SARUA should promote ICTs and its members’ related interests at the national and regional levels. Interestingly, while three quarters of the respondents would like to see SARUA involved in creating RENs, only 42% think that SARUA should actually run and manage the regional REN. This probably is an indication that the majority of SARUA’s members do not expect the Association to get involved in physical implementation and operations.

<table>
<thead>
<tr>
<th>Proposed role</th>
<th>Provide strategic advice</th>
<th>Bandwidth consolidator</th>
<th>Organize training (capacity building)</th>
<th>Assist in creating RENs</th>
<th>Manage and run regional REN</th>
<th>Advocacy at national and regional levels</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of respondents supporting the role</td>
<td>9</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>5</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>%age of respondents supporting the role</td>
<td>75%</td>
<td>58%</td>
<td>67%</td>
<td>75%</td>
<td>42%</td>
<td>67%</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 26- Institutions responses to proposed roles for SARUA

It is also instructive to present the “other” roles that survey respondents proposed for SARUA:

- Mentoring
- Assist in identifying cheap and affordable bandwidth providers
- Securing dedicated state funding for ICT initiatives
- Organizing ICT training for senior managers
- e-learning capacity building
- Play a role in collaboration with TENET, the HESA formed a Section 21 company that acts as agent for HE and research institutions to ensure that the landing of the SEACOM cable is allowed by government. Collaborate with the Merake Institute in the creation of the government SANREN (research network of SA and the NREN developed by TENET that connects to the European GEANT network) rather than aspiring to create yet another NREN, duplicating resources
- Setting up a Committee of ALL Directors of Computer Centres from ALL our Universities so as to share experiences. This Team should be carrying out visitations to each of the universities in SARUA to talk to administrators and so on.

A careful review of these proposed roles also shows that they are in line with the roles identified from the strategic analysis above.
6.3 Work Streams

From the strategic analysis above and the identified roles for SARUA, a number of “work streams” or activities and strategies to realize these activities have been proposed. It is important to note that the strategies and activities proposed are of a more general nature rather than precise and prescriptive. This is deliberate as it is believed that the precise nature of the activities should be determined in consultation with member institutions in order to build support and buy-in for any activities to be undertaken.

6.3.1 Improve the campus infrastructure of member institutions

As discussed in section 3, there are many capacity constraints and gaps in the campus infrastructure of member institutions. SARUA should encourage and support member institutions to develop and upgrade their campus infrastructure. The targets should be to have every member institution:

a) Deploy a multi-Gigabit fibre-based backbone network covering the entire campus
b) Ensure that all buildings used for administration, teaching and research are full networked with robust, high capacity Local Area Networks (LANs)
c) Ensure that students and staff have adequate access to computing resources
d) Ensure that management information systems are deployed to strengthen administrative and management functions

Short Term Strategy

• Work with member institutions to develop a shared vision for a “university of the future” or a “smart campus”. Such a shared vision is important in ensuring understanding of the role of ICTs, provides critical input in the development of the institutions’ ICT strategic plans and leads to alignment of members’ plans. Most importantly, the visioning exercise will expose members to the potential of ICTs in transforming their institutions, which will eventually translate to support for national and regional initiatives and increased investment in the critical campus infrastructure.

• From the vision of a smart campus, SARUA can encourage members to design and develop modular models for deploying campus infrastructure, along with supporting organizational and management structures and policies that will enable the vision to be realized. Such a modular model will ensure that members can deploy the critical modules first and add on other modules as financial and human resources become available.

SARUA should organize a “visioning” workshop that brings together the heads of its member institutions and the heads of the ICT departments in the member institutions to develop a shared vision and a modular model for deployment. SARUA can also organize for networking and other ICT experts to provide technical design input to the workshop.

Medium term strategy

• Develop a classification framework for measuring levels of development of campus infrastructure and enable design targeted assistance according to the level of ICT development. It is important to note that not all universities are at the same level of ICT development. Some institutions are more developed than others, and therefore a “one size fits all” approach cannot be applied in this case. Once the classification is undertaken, SARUA can identify targeted support that has a higher chance of adding value to its members’ activities than trying to treat all members the same. SARUA could also motivate for more developed institutions to support their less developed peers through “twinning” mechanisms, such as exchange visits among the IT staff and secondments of ICT staff. These activities can also be undertaken in the short term.

At the conclusion of the visioning and modelling exercise, SARUA could commission a mapping exercise that maps existing infrastructure at all its member institutions against the “smart campus” requirements. From this exercise, identify the gaps at each institution and develop a classification framework for institutions that reflect the level of development of ICTs in relation to the ideal smart campus model.

• Lobby major donors for funds and technical assistance to improve the campus infrastructure of member institutions.
6.3.2 ICT organizational structures, management and policies

As noted in section 2.1.1, a few universities have not established centralized ICT units or have not enacted some of the most important ICT policies. Also, a major challenge that SARUA member institutions face is the lack of skilled staff to manage, support and maintain ICT infrastructure. SARUA could play an important role in supporting institutions to develop their ICT management capabilities and to develop appropriate policies and strategies for management and procurement.

Short term strategy

- Develop ICT “guides” or “handbooks” which members can use for reference in the development and improvement of their own management structures and policies. Such guides should draw on good practices identified from among member institutions and from other institutions around the world. Some of the guides could cover topics such as:
  - Appropriate organizational structures and staffing levels and skills;
  - Development of ICT standards and sample ICT standards templates
  - Development of appropriate policies, strategic and action plans
  - Bandwidth management
  - Development of appropriate support and maintenance structures and plans

Identify ICT experts within the member institutions and commission these experts to develop the necessary guides and handbooks. Once these are developed, they should be posted on the SARUA website for each access and dissemination.

- Develop training programmes for management and technical staff. It is not enough to provide appropriate documentation; the capacity of management and technical staff must also be built to ensure that they contribute positively to the development and improvement of infrastructure and systems. This training could be carried out in collaboration with expert organizations such as Africa Network Operators Group (AfNOG). SARUA could identify individual experts within its member institutions who could be used as resource people for such capacity building programmes.

Through potential technical partners such as TENET and INASP, SARUA should undertake a Training Needs Assessment (TNA) for all member institutions’ ICT staff and organize and facilitate training workshops targeting identified needs.

- Consider setting up an ICT Security Advisory Group composed of skilled members of staff at member universities to provide advice and technical assistance to members on matters of campus network and information security. Through technical partners SARUA might consider assisting some member institutions to set up and run “security incidence and response centres” to keep track of security related issues and advise member institutions on courses of action.

Long term strategy

- Support the establishment of an ICT procurement consortium. As has been noted in section 2.1.3, many universities lack ICT standards and very few undertake centralized procurement. This means that these universities are unable to reap the benefits of standardization and volume purchasing to lower acquisition and operational costs. SARUA could coordinate and facilitate its members to jointly develop ICT standards and to form ICT equipment and services purchasing consortia just as they are doing for bandwidth in order to leverage collective purchasing and bargaining power to negotiate for volume discounts.

6.3.3 Creation of a regional REN

It is tempting to think of a regional REN as a distinct entity or organization. It is also tempting to consider SARUA establishing and managing the regional REN. However, this temptation should be overcome when one realizes that there already exists a plan to create a Southern Africa regional REN by the UbuntuNet Alliance (UA) known as the “Southern Cluster”. With UA already established and with its plans to create a regional REN, creating an additional entity would lead to duplication of efforts with the accompanying wasting of time and resources. Another factor to consider is that three
SARUA member country NRENs are founding members of UA (South Africa, Mozambique and Malawi) while at least three more are actively interacting with UA (Zimbabwe, Zambia, DRC). It is therefore prudent and opportune for SARUA to establish a strategic relationship and support UA in achieving the Southern Cluster rather than try to establish a competing structure.

6.3.3.1 Relationship between UbuntuNet Alliance and SARUA

The very nature of the two organizations (SARUA and UA) makes a strategic relationship possible and beneficial to all. UA is more of a technical organization focused on implementation – on building the necessary fibre infrastructure to connect its member institutions – but currently lacks the necessary political support to negotiate the complex campus-politic and national regulatory environments in order to access some of the existing fibre resources. SARUA on the other hand is more of a facilitative organization with the potential to marshal plenty of “political” support at the institutional and regional level but lacks the technical capacity to carry out any ICT implementation activities. The two organizations could, therefore, complement each other perfectly. In fact, SARUA and UA already have an important historical relationship: UA was born out of SARUA’s study of the feasibility of using fibre for research and education in the East and Southern Africa regions. By collaborating, the two institutions would increase their collective strengths while negating their relative weaknesses. SARUA should also seek to engage with the Partnership for Higher Education in Africa (PHEA) VSAT Bandwidth consortium either through UA or directly in order to make available cheaper VSAT bandwidth to its members that rely on VSAT for access to the Internet. This collaboration with the Bandwidth Consortium should eventually be folded into the larger UA partnership especially as UA and PHEA VSAT Bandwidth Consortium are discussing a potential merger.

Execution Strategy

In order to cement a collaborative relationship, SARUA should enter into a formal strategic partnership with UbuntuNet Alliance through a Memorandum of Understanding (MoU) or similar mechanism. Under such a strategic partnership, UA should develop and present to SARUA a concrete plan to develop the Southern Cluster, with an objective and feasible network design, realistic timelines and a detailed financial plan.

SARUA on its part should mobilize its members, especially the Vice Chancellors, to review and support UA’s plan, the individual national plans to develop NRENs, and to launch an advocacy campaign in support of the Southern Cluster and UA’s plans, targeting:

- The national and regional infrastructure providers (such as SAPP and Motraco)
- National and regional regulatory authorities
- Donors who provide funding for connectivity infrastructure in the region such as the World Bank and Swedish International Development Agency (SIDA) and who could influence the telecommunication companies they support to provide infrastructure for NRENs and the Southern Cluster.
- Political entities like NEPAD, SADC, African Union (AU) and the European Union (EU)

6.3.4 Promote institutional collaboration leveraging ICTs

As discussed in section 3, there is a dearth of advanced and collaborative research in the region. As SARUA aims to promote regional collaborative research, leveraging the creation of a regional REN would be a major support to enable such collaboration and high-level research and knowledge exchange.

Short term strategy

- Research: SARUA should undertake a detailed assessment of current and planned research activities in all member institutions in order to better understand the research and networking needs of its member institutions.
- Knowledge Exchange: SARUA should strive to promote and facilitate knowledge exchange among its member institutions. Activities under such an initiative would include:
- Building and maintaining an up-to-date database of Heads of ICT of member institutions
- Developing forums and mailing lists for heads of ICTs to exchange experiences and knowledge
- Host and facilitate an annual or bi-annual meeting of Heads of ICTs to share experiences and resources
- Publish a quarterly newsletter on developments in ICT4E in the member institutions, the region and internationally.

Medium term strategy
SARUA should lobby the SADC Secretariat and member governments to invest in advanced science and technology infrastructure for research. Where necessary SARUA should also negotiate with countries which have existing or planned advanced research facilities to encourage them to make them available to member institutions at low cost. An example of such existing or planned facilities that could be shared by all the regional institutions is the planned Centre for High Performance Computing (CHPC) in South Africa.
7 CONCLUSION

Information and Communication Technologies (ICTs) have become a necessary and indispensable tool for higher education institutions all over the world. They aid all the operations of an academic institution including management and administration, teaching and learning and research, and provide a fundamental set of tools for building the knowledge economy.

SADC universities are actively integrating ICTs in all their operations. All the universities have some access to the internet, have developed campus networks, have provided a relatively decent level of computer access to teaching, research and administrative research, have deployed management information systems and have started e-learning initiatives. Despite these best efforts, they are constrained in many ways and gaps in infrastructure, systems and capacities exist.

These gaps and constraints are not insurmountable and SARUA has an important role to play in addressing them. The strategy that SARUA should adopt must be one that seeks to strengthen its members existing and on-going efforts and not to duplicate or compete with them. Most importantly, as the ICT landscape is one that evolves and changes rapidly, SARUA must keep in regular contact with its members in order to better understand their needs and demands and appreciate their efforts. Therefore, any strategy or activities that SARUA undertakes must be flexible and continually evaluated to determine that they fit with its members needs.
Survey of ICT in the SADC Region

Higher Education Institution Questionnaire

Instructions for Completing the Questionnaire

Please enter all of your responses in the tick boxes, tables or text boxes located next to each question. If possible, complete the questionnaire electronically using Microsoft Word. This should make completing the questionnaire easier for you, and will also facilitate our analysis of the responses.

The document has been formatted so that you can enter your responses only in the tick boxes or the grey coloured boxes. To complete the questionnaire electronically go to the first question and use the mouse to place the cursor inside the grey box at the end of the question (like the example below). You can then type in your answer.

Sample Question 1: What is today’s date?
Please note that the text boxes are formatted to expand automatically to accept your answer. When you have completed the first question, use the mouse or right arrow key to move to the next grey coloured box and complete that question.

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

For questions that require a Yes/No response (like the example to the right), place your cursor over the small box that you want to tick and click the mouse. This will place an X in the box. If you accidentally tick the wrong box, or tick both boxes, just click on the box again and the X will be removed.

Questionnaires that are completed electronically should be e-mailed to operations@sarua.org so that they arrive no later than Friday, 5th October 2007.

If you have any questions regarding this questionnaire or the study, please contact SARUA by email at info@sarua.org or by telephone on +27 11 717 8381 or by fax on +27 11 717 8382. If you would like further information regarding SARUA, please visit our website at www.sarua.org.

Your time and effort in completing this questionnaire are greatly appreciated.

Section A: General Organisational Details

4. Name of Institution
5. City, Country
6. Website address
7. Number of full time students
8. Number of part time students
9. Number of teaching and research staff
10. Number of non teaching/ administrative staff
Section B: ICT Management

11. Do you have a dedicated/centralized ICT unit?
   - Yes
   - No

   If yes, who does the head of the ICT unit report to (e.g. VC, Deputy VC, etc)?

12. Do you have a dedicated/centralized E-learning unit?
   - Yes
   - No

   If yes, is the E-learning unit separate from or part of the ICT unit?
   - Part of ICT Unit
   - Separate

13. Are there any donors who pay for, or have paid for, any ICT systems and services?
   - Yes
   - No

   If yes, please name the donor and describe the services paid for.
   - Name of donor
   - Services paid for

14. Is your institution part of any regional ICT partnership?
   - Yes
   - No

15. Does your institution have any of the following policies/plans?

<table>
<thead>
<tr>
<th>Policy/plan</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ICT Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. ICT Strategic Plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Acceptable Use Policy (AUP) for all users</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Privacy Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. ICT Security Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Bandwidth Management Policy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. Open Source Policy</td>
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16. Monitoring

<table>
<thead>
<tr>
<th>Monitoring</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Do you monitor your internet bandwidth?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Do you have any bandwidth management solutions in place?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Do you monitor your campus network/ backbone?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Do you scan and block viruses entering the network?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. Do you have any spam management in place?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>f. Do you have any web caching in place?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

17. Procurement

<table>
<thead>
<tr>
<th>Procurement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Do you have ICT standards for all hardware and software?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Does the ICT unit procure all hardware and software on behalf of other departments (i.e., is ICT procurement centralised)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If NO, is the ICT unit consulted when other departments make hardware and software purchases?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

18. What are the top 5 challenges facing the ICT department at your institution?

<table>
<thead>
<tr>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>5.</td>
</tr>
</tbody>
</table>
### Section C: Infrastructure and Connectivity

19. Please complete the table below regarding internet connectivity.

<table>
<thead>
<tr>
<th>Type of physical connection</th>
<th>Uplink speed</th>
<th>Downlink speed</th>
<th>CIR</th>
<th>Bursting capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leased Line (fiber)</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Leased Line (wire)</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Leased line (wireless)</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>VSAT</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Dial up</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Other, please specify</td>
<td></td>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

20. In the table below, please indicate the MONTHLY bandwidth CAPACITY and COST for each type(s) of physical connection to the internet that your institution has.

<table>
<thead>
<tr>
<th>Type of physical connection</th>
<th>Monthly bandwidth COST</th>
<th>Monthly bandwidth CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leased Line (fiber)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leased Line (wire)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leased line (wireless)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VSAT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dial up</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, please specify</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

21. Please estimate what your institution expects its bandwidth requirement will be in 5 years time:

22. What type(s) of ICT service provider(s) does your institution use? In the table below, please tick all the types that apply.

<table>
<thead>
<tr>
<th>Type of ICT Service Provider</th>
<th>National Research and Education Network (NREN)</th>
<th>Bandwidth consortium</th>
<th>Private ISP</th>
<th>National Telecom</th>
<th>VSAT company</th>
<th>Other, please describe</th>
</tr>
</thead>
</table>

23. Does your institution have a campus internet backbone?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If yes, please complete the table below regarding the type(s) and the capacity/ bandwidth of each backbone connection at your institution.

<table>
<thead>
<tr>
<th>Type of Backbone Connection</th>
<th>Capacity/ Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiber optic</td>
<td></td>
</tr>
<tr>
<td>Copper (10base t or 100base T)</td>
<td></td>
</tr>
<tr>
<td>Wireless</td>
<td></td>
</tr>
</tbody>
</table>

24. Do all office and teaching/ research buildings at your institution have Local Area Networks (LANs)?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If NO, what percentage of buildings DO have LANs? %

If some buildings have LANs, what type of LAN connections are used? Please tick all that apply.

<table>
<thead>
<tr>
<th>Type of LAN</th>
<th>Fiber optic</th>
<th>Copper (10base t or 100base T)</th>
<th>Wireless</th>
</tr>
</thead>
</table>

25. How many servers does your institution have in TOTAL?

26. How many servers are central servers (i.e. shared by the entire campus)?

27. How many servers are departmental servers (i.e. used only by a single department/ faculty)?

28. Do you have a dedicated server room(s)?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>
If yes, please complete the table below.

| a. Does the server room(s) have air conditioning? | Yes | No |
| b. Does the server room(s) have electrical backup? | Yes | No |
| If yes, what type(s) of electrical backup does the server room have? (Please tick all types that apply) | Generator | Yes | No |
| | UPS | Yes | No |
| | Solar | Yes | No |
| | Other, please specify: | Yes | No |

29. Please complete the table below regarding PCs at your institution.

| How many PC do you have at your institution? | |
| Total number of PCs | |
| Total number of networked PCs | |
| Total number of PCs with internet connection | |
| Total number of PCs dedicated to students | |
| Total number of PCs dedicated to lecturers/researchers | |
| Total number of PCs dedicated to administration | |

30. Does your institution have a scheme(s) to provide teaching/research staff with personal PCs or laptops (e.g. loan or lease scheme, negotiated contract with private provider, etc.)?

| Yes | No |

If yes, please briefly describe the scheme(s):

31. Does your institution have a scheme(s) to provide students with personal PCs or laptops?

| Yes | No |

If yes, please briefly describe the scheme(s):

32. Does your institution expect graduate and post graduate students to purchase their own personal PCs or laptops?

| Yes | No |

33. Do you have any volume licensing agreements or other large negotiated contracts for PC and/or server software and applications?

| Yes | No |

If yes, please provide details of the agreement (including the vendors name):

34. Do you have any Open Source policies in place?

| Yes | No |

If yes, do these cover:

| Hardware | Software |

35. In the table below, please indicate the ways your institution uses its internet connection. Please tick ALL categories that apply.

| Ways that your institution uses its internet connection: | |
| General internet browsing | |
| Voice over internet protocol (VOIP) | |
| Video conferencing | |
| Electronic mail (email) | |
| Research | |
| If you ticked the research box, please briefly describe how the internet is used for research at your institution: | |
| E-learning | |
| If you ticked the e-learning box, please briefly describe how the internet is used for e-learning at your institution: | |
| Other, please specify: | |

36. Does your institution have an email domain?

| Yes | No |

If yes, what is your institution’s email domain:
37. Does your institution have an e-learning policy?

Yes  No

38. Does your institution have any e-learning applications (e.g. Blackboard, WebCT, etc.) installed?

Yes  No

39. Does your institution have any e-learning initiatives underway or planned?

Yes  No

If yes, please briefly describe the e-learning initiatives that are underway or planned at your institution:

40. Which, if any, of the following types of Information Management Systems (IMS) does your institution currently have installed?

<table>
<thead>
<tr>
<th>Type of IMS</th>
<th>Installed</th>
<th>If Yes, Please name the system and version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student management</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Student registration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Library</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other, please specify:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

41. Does your institution provide professional development courses in how to use E-learning?

Yes  No

If yes, please briefly describe what topics these E-learning courses cover:

42. Does your institution provide basic IT training for teaching staff?

Yes  No

43. Does your institution provide basic IT training for ALL students?

Yes  No

44. Does your institution provide basic IT training only for students in SOME departments/faculties?

Yes  No

If yes, please indicate which departments/faculties provide basic IT training for their students:

Section E: Role of SARUA

45. What role(s) do you think SARUA can best play in the area of ICT at your institution? Please tick all categories that apply:

- Provide strategic advice
- Bandwidth aggregator/consolidation
- Organise training workshops, e.g. on bandwidth management
- Assist in creating a regional Research and Education Network (RREN)
- Manage and run a regional REN
- Advocacy at the national and regional level
- None at all
- Other, please specify:

46. Please describe any other ways that you think SARUA can assist your institution in developing, improving and utilizing ICT:

Thank you for your time and effort in completing this questionnaire!
### APPENDIX 2 - Access to Computing Resources - Details

<table>
<thead>
<tr>
<th>Name of university</th>
<th>Country</th>
<th>Total No of PCs</th>
<th>Total No of PCs networked</th>
<th>Total No of PCs with Internet</th>
<th>PCs for Students</th>
<th>PCs for teaching staff</th>
<th>PCs for admin/ Non teaching staff</th>
<th>Student: PC ratio</th>
<th>Student: PC (full time only)</th>
<th>teaching staff: PC</th>
<th>Admin/ Non teaching: PC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodes University</td>
<td>South Africa</td>
<td>5 500</td>
<td>5 500</td>
<td>5 500</td>
<td>3 500</td>
<td>1 000</td>
<td>1 000</td>
<td>1.69</td>
<td>1.69</td>
<td>0.30</td>
<td>0.70</td>
</tr>
<tr>
<td>Mangosuthu Technikon</td>
<td>South Africa</td>
<td>1 000</td>
<td>1 000</td>
<td>1 000</td>
<td>6 000</td>
<td>200</td>
<td>200</td>
<td>15.32</td>
<td>15.05</td>
<td>1.11</td>
<td>1.75</td>
</tr>
<tr>
<td>Eduardo Mondlane University</td>
<td>Mozambique</td>
<td>2 000</td>
<td>2 000</td>
<td>2 000</td>
<td>750</td>
<td>250</td>
<td>1 000</td>
<td>18.67</td>
<td>18.67</td>
<td>5.50</td>
<td>2.42</td>
</tr>
<tr>
<td>University of Joburg</td>
<td>South Africa</td>
<td>6 500</td>
<td>6 500</td>
<td>5 000</td>
<td>2 200</td>
<td>2 700</td>
<td>1 600</td>
<td>21.94</td>
<td>19.90</td>
<td>1.11</td>
<td>2.69</td>
</tr>
<tr>
<td>Open university of Tanzania</td>
<td>Tanzania</td>
<td>200</td>
<td>150</td>
<td>200</td>
<td>50</td>
<td>100</td>
<td>50</td>
<td>240.00</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>University of Malawi</td>
<td>Malawi</td>
<td>770</td>
<td>699</td>
<td>6.89</td>
<td>230</td>
<td>235</td>
<td>105</td>
<td>13.44</td>
<td>13.44</td>
<td>1.56</td>
<td>5.93</td>
</tr>
<tr>
<td>University of Goma</td>
<td>DRC</td>
<td>35</td>
<td>12</td>
<td>8</td>
<td>120</td>
<td>105</td>
<td>100</td>
<td>10.50</td>
<td>9.8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bindura University</td>
<td>Zimbabwe</td>
<td>800</td>
<td>700</td>
<td>700</td>
<td>450</td>
<td>200</td>
<td>50</td>
<td>4.67</td>
<td>4.44</td>
<td>1.28</td>
<td>3.46</td>
</tr>
<tr>
<td>Central University of Technology, Free State</td>
<td>South Africa</td>
<td>2 398</td>
<td>2 331</td>
<td>2 169</td>
<td>1 510</td>
<td>520</td>
<td>368</td>
<td>6.94</td>
<td>5.61</td>
<td>1.23</td>
<td>1.50</td>
</tr>
<tr>
<td>Nelson Mandela Metropolitan University (MMMU)</td>
<td>South Africa</td>
<td>5 500</td>
<td>5 300</td>
<td>5 300</td>
<td>3 000</td>
<td>1 100</td>
<td>1 200</td>
<td>7.83</td>
<td>5.27</td>
<td>1.45</td>
<td>2.25</td>
</tr>
<tr>
<td>University of Zambia</td>
<td>Zambia</td>
<td>2 001</td>
<td>1 800</td>
<td>1 800</td>
<td>90</td>
<td>350</td>
<td>1 450</td>
<td>90.52</td>
<td>88.72</td>
<td>1.37</td>
<td>0.84</td>
</tr>
<tr>
<td>Sokoine University of Agric</td>
<td>Tanzania</td>
<td>585</td>
<td>300</td>
<td>300</td>
<td>80</td>
<td>220</td>
<td>285</td>
<td>31.25</td>
<td>31.25</td>
<td>1.64</td>
<td>2.74</td>
</tr>
</tbody>
</table>
### APPENDIX 3 - Connectivity Details

<table>
<thead>
<tr>
<th>Type of connection</th>
<th>Provider</th>
<th>BW uplink (Mbps)</th>
<th>BW down (Mbps)</th>
<th>Cost US$</th>
<th>Cost per kbps</th>
<th>Expected bandwidth in 5 years (Mbps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodes university</td>
<td>Fiber</td>
<td>10</td>
<td>10</td>
<td>$40,697.67</td>
<td>$2.03</td>
<td>1,000</td>
</tr>
<tr>
<td>Mangosuthu Technikon</td>
<td>Leased wire</td>
<td>NREN</td>
<td>1</td>
<td>$3,779.07</td>
<td>$1.89</td>
<td>10</td>
</tr>
<tr>
<td>Eduardo Mondlane University</td>
<td>Leased fiber</td>
<td>National telecom</td>
<td>3</td>
<td>$9,500.00</td>
<td>$1.58</td>
<td>50</td>
</tr>
<tr>
<td>University of Joburg</td>
<td>Fiber</td>
<td>bandwidth consortium</td>
<td>16</td>
<td>$101,744.19</td>
<td>$3.18</td>
<td>100</td>
</tr>
<tr>
<td>Open university of Tanzania</td>
<td>Fiber</td>
<td>Private ISP</td>
<td>0.256</td>
<td>0.128</td>
<td>$1,600.00</td>
<td>$4.17</td>
</tr>
<tr>
<td>University of Malawi</td>
<td>leased wire, VSAT</td>
<td>NREN, VSAT, private ISP</td>
<td>0.704</td>
<td>1.92</td>
<td>$8,240</td>
<td>$3.14</td>
</tr>
<tr>
<td>University of Goma</td>
<td>leased wireless</td>
<td>Private ISP</td>
<td>0.032</td>
<td>0.064</td>
<td>$300</td>
<td>$3.13</td>
</tr>
<tr>
<td>Binduru University</td>
<td>Leased wire</td>
<td>National telecom</td>
<td>1</td>
<td>1</td>
<td>$500.02</td>
<td>$0.25</td>
</tr>
<tr>
<td>Central University of Technology, Free State</td>
<td>Leased wire</td>
<td>NREN</td>
<td>5</td>
<td>5</td>
<td>$20,348.84</td>
<td>$2.03</td>
</tr>
<tr>
<td>Nelson Mandela Metropolitan University (NMMU)</td>
<td>Leased wire</td>
<td>Bandwidth consortium/Private ISP</td>
<td>8.5</td>
<td>8.5</td>
<td>$25,436.05</td>
<td>$1.50</td>
</tr>
<tr>
<td>University of Zambia</td>
<td>VSAT</td>
<td>VSAT company</td>
<td>1</td>
<td>4</td>
<td>$26,000.00</td>
<td>$5.20</td>
</tr>
<tr>
<td>Sokoine University of Agric</td>
<td>Leased wire</td>
<td>National telecom</td>
<td>0.256</td>
<td>0.512</td>
<td>$2,600.78</td>
<td>$3.39</td>
</tr>
</tbody>
</table>
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SERENATE- Study into European Research and Education Networking as Targeted by eEurope, Deliverable D21, SERANTE Consortium <http://www.serenate.org/publications/> <http://www.serenate.org/publications/> >


