2009/ED/HED/FRK/ME/6
Original: English

United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

UNESCO Forum on Higher Education, Research and Knowledge
Workshop on Research in Diverse Social Contexts:
Tensions, Dynamics and Challenges
(UNESCO, Paris, 19-21 March 2009).

Introductory viewpoint

Research and Information Technology Connectivity - Opportunities for Innovation and Issues for Africa

By

Olusola Oyewole,
Coordinator,
Mobilizing Regional Capacity Initiatives
Association of African Universities (AAU)
Accra, Ghana.

1. Introduction

The importance of knowledge as a critical element of sustainable development in today's competitive global economy is well known. People and nations therefore need to be challenged to create, access and employ knowledge to be able to meet the challenges of life and survive in our ever-changing world. This challenge cannot be met if the quest for knowledge through research is not attended to. Higher Education Institutions especially Universities have for all time been identified as the space for generating knowledge through research.

Unfortunately, for many African countries, higher education had witnessed a long period of relative neglect and stagnation. Many higher Education Institutions, especially Universities in Africa, are burdened with a myriad of problems to the extent that they have little time and resources for effective research. Research as connoted in this article refers to independent intellectual enquiry into diverse disciplines and areas, and which leads to the creation of new and significant knowledge.

The modern world is currently being transformed through research. The growth of nations and indeed, the economics of nations today depend on their commitments to knowledge generation and utilization through research. One of the failures in the African continent is the failure of many nations in Africa to accord research the priority it deserves. Research is strategically important in Universities, as it is necessary to facilitate good quality undergraduate and graduate training, help universities to motivate and empower its researchers and promote the training of future researchers. Many African Universities have lost the

capacity for doing sustainable research. As early as 1964, at a UNESCO meeting held in Nigeria, African countries, recognizing the importance of research to their national development, committed themselves to spend at least 0.5% of their Gross National products on scientific research. Unfortunately, most countries in Africa have not been able to stand up to this challenge.

Today, these are over 2300 higher tertiary institutions in Africa, enrolling 6.2 million students. Within the past ten years, Africa has witness a high growth in the number of private and distance learning tertiary institutions. This is partly because the public institutions that had been in existence for many years can no longer cope with the increasing population and high demand for education in the continent. This not-withstanding, Africa tertiary gross enrolment, which is just 5%, is still the least when compared to North America with 70% and Europe with over 24%.

Research in Africa is facing a lot of challenges. It is known that sub-Saharan Africa spends less than 0.3% of its GNP on research and the region has been identified as the region that contributes the least to research funding in the world. Africa's share of global scientific output has fallen from 0.5% in the mid-1980s to 0.3% in the mid-1990s. Apart from this, Africa accounts for the lowest ratio of researchers per million inhabitants in the world. Africa, which accounts for 12% of the world population accounts for less than 1.5% of research publications annually.

Most research in Africa is carried out in the tertiary institutions set-ups. These research institutions are limited by poor infrastructures, ill-motivated staff, incessant and inadequate power and water supply, out-dated equipment, poor funding and poor connectivity to the rest of the world. The last problem of poor connectivity is due to the poor state of telecommunication infrastructure in the continent.

Barry (2008)[1] captures the challenges and the peculiar state of telecommunication in Africa when he noted that "with a population of 955 million, representing approximately 14% of the world population, Africa has a telephone penetration of 3.8% (world average: 19%), only 5.3% Internet penetration (world average: 22%; North America:73%) and has only -.2% of world's total internet capacity".

[1] Boubakar Barry (2008) Research and Education Networking in Africa. DFN Mitteilungen Ausgabe, 75, 28-31.

Reding (2008)[2] commented that 'research today is truly global, and scientists, academics and students rely on networks such as the Europe's GEAN to pool resources and to work together effectively, no matter where they are based'. For African tertiary educational institutions to carry out meaningful research in today's world, they need good internet connectivity. This is especially necessary today, when there are many research related electronic educational and scientific contents, such as African Digital library, HINARI, AGORA, PERI and JSTOR, which can only be accessed when the research institutions have adequate and good internet connectivity. In order to improve the effectiveness of African research and educational systems, the Information Communicational Technology (ICT) of these institutions need to be improved.

2. State of Information Communicational Technology (ICT) Infrastructures in Africa.

Gakio (2006)[3] has described the state of Internet connectivity in tertiary institutions in Africa as 'too little, too expensive and poorly managed'. According to this report, the average African university has bandwidth capacity equivalent to a broadband residential connection available in Europe, pays 50 times more for their bandwidth than their educational counterparts in the rest of the world and fails to monitor, the existing bandwidth or us it appropriately for its research and educational purposes.

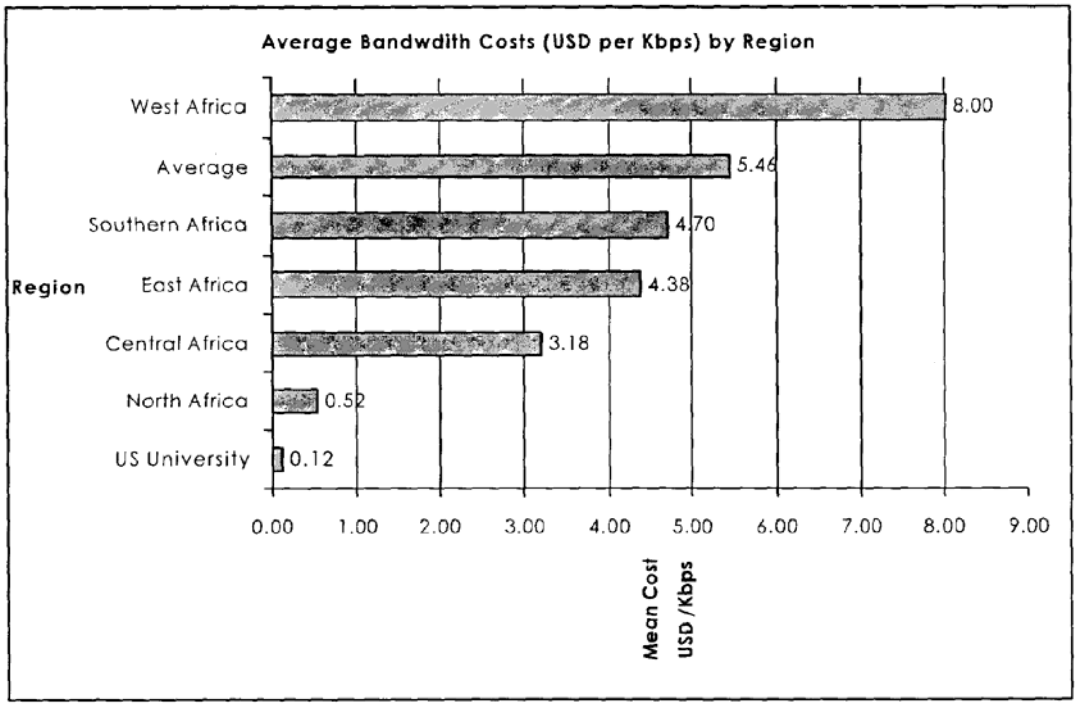
In June, 2008, the Association of African Universities (AAU)[4] carried out a connectivity survey of 51 Higher Education Institutions (HEIs) in nine West African countries. Findings in this survey are a reflection of the situation in many parts of Africa. The findings of this study showed that there is a bandwidth deficit for HEIs in the West and Central Africa region. The 2.2 million staff and students in this region have an average of 0.37 Kbps per head. The deficit is by no means unique to academic institutions, but reflects the structure of the supply chain for international Internet bandwidth for Africa as a whole. The price and availability of external bandwidth for HEIs is different between those which are located near to the core of the Internet universe and can

[2] Reding Viviane (2008). Quoted in Global research community bridges digital divide between Africa and Europe through high speed network link. (Pres release).GEANT2.
[3] Gakio Karanja (2006) African tertiary institutions connectivity surveys (ATICS), 2006 report.
[4] Paul Hamilton, Clement Dzidonou, Aminu Ibrahim, Tiermoman Kone, Claude Lishou, Souleymane Oumtanaga, Oumarou Sie and Emmanuel Tonye (2008) AAU Connectivity survey – Addressing the demand for connectivity of Higher Education Institutions (HEIs) in the West and Central Africa Region. AAU. I October, 2008

achieve connectivity using domestic dark fibre, and those on the periphery which must pay for an international connection via satellite. HEIs in Western Europe, North America, and the Asian hub countries only need a domestic leased line to a Tier 1 Internet backbone provider (IBP) in order to obtain their upstream Internet connectivity. Their counterparts in Africa and other developing regions are required to buy international capacity to reach the same IBPs in order to obtain their upstream Internet connectivity. The supply of this international bandwidth is limited to the capacity which is available on satellites and submarine cables serving the region. Under the structure of commercial interconnect agreement; the African customer is required to pay the full cost of that international connectivity and both 'halves' of the circuit. The implication of these is that African research community need to pay more for their bandwidth needs than the rest of the world.

The North Africa institutions are the most advanced in Africa because universities in these countries are connected to the European Union MED Connect project, which links them via high speed undersea fibre networks to the European Academic and Research Network (GEANT).

Average Bandwidth Costs/Kbps by Region



Source: ATICS 2005

The ATICS surveys compared the situation of things between 2004 and 2006 in Africa and found that the majority of universities sampled use terrestrial based leased lines for connectivity purposes with satellite (VSAT) coming in second place; where in 2006, 69% as against 64% in 2004 use terrestrial leased lines (wire, fibre or radio link) for connectivity to their ISPs, while 25% in 2006 as against 29% use VSAT., while over 6% of institutions still rely on dial up connections for their internet connectivity.

All the surveys so far carried out found that tertiary institutions which buy their bandwidth as part of a network or consortium obtain the most cost-effective bandwidth, and also that the greater the volume of bandwidth being purchased, the lower the marginal cost of that bandwidth.

Regulatory restrictions on the use of VSAT are a major issue faced by many African institutions. Many institutions find it difficult to obtain VSATs licenses, possibly due to prohibitive restrictions and regulations on VSATs in their various countries

3. Challenges of Information Technology in Africa

The challenges facing Information Technology has been explained by the Association of African Universities' (2008)[5] and these include:

(a) The Bandwidth Limitations:

Limited bandwidth and its high cost are the major problems that inhibit communication and collaboration between academic and research institutions in Africa. The absence of connectivity to fibre backbone makes many of the countries to be dependent on low bandwidth and costly satellite links. Fibre optic, which offers better confidentiality and security, high bandwidth, better reliability, high signal quality, longer lifetime and low service cost, is believed to remove some of the challenges of academic connectivity.

[5] AAU (2008) Turn on the NREN Wheel: Technical, Organizational, Regulatory, Political and Financial Issues of National and Regional Research and Educational Networks. Briefing papers for university leaders and policy makers.. Ed. Lishan Adam and Boubakar Barry. AAU. 40 pages.

The Bandwidth challenge is currently being met by the various Academic and Research Networks[6] which are evolving in Africa. The National Regional Research and Educational Network Initiatives are forming regional consortia to foster cooperation, mobilize resources and work around regulatory and policy challenges. One of these is the UbuntuNet Alliance, founded in 2005, which vision is to ensure that Africa participate effectively in the global research community. In 2008, a high speed network link connecting the UbuntuNet Alliance hub in London to the international research community via the European GEANT2 network was completed.

(b) Bandwidth Management:
Apart from the limited bandwidth, the improper use of existing connectivity is a major challenge. Ineffective utilization of existing bandwidth, due to absence of bandwidth management strategies promotes bandwidth wastage on unwanted traffic (viruses, music and movie download, etc). Institutions therefore need to put in place necessary policies for optimizing the available bandwidth in academic and research institutions.

(c) Human resources:
Lack of skilled human capacity in many countries is a limitation to the use of IT connectivity for research. Human resources are needed to evolve the necessary vision and policy frameworks for ICT.

(d) Policy and regulatory Challenge:
There are many regulatory policies affecting IT connectivity for research in some countries. These include:

- Restrictive telecommunication s sector policy and regulations that constrain academic institutions from owning and operating satellite or fibre networks;
- Lack of clear policy and regulations on the status of academic and research networks;
- Lack of open access to fibre networks and lack of competition

[6] Other National Research and Educational Networks in Africa include: (a) Tertiary Education Networks (TENET) in South Africa; (b) Kenya Education Network(KENET) in Kenya; (c) EUMEDCONNECT in North Africa; (d) EUN, Egypt; (e) ENERGI, Egypt; (f) MARWAN2 in Morocco; (g) TUNET in Tunisia; (h) GHARNET in Ghana; (i) MAREN in Malawi; (j) MoRENet in Mozambique; (k) RENU in Uganda; (l) SUIN in Sudan; (m) ZAMREN in Zambia and RWEDNET in Rwanda. New ones are currently evolving.

(e) Poor Networking and Lack of Regional Collaborations and Cooperation:

Inadequate cooperation and collaborations among academic and research in Africa limit experience sharing and promotes uncoordinated programmes on ICT programmes. It is to meet this challenge that the National Educational and Research Networks are being formed. Their existence has been helping to facilitate high speed broadband links among partner universities and research institutions. They have also been useful in helping institutions to access cheaper and high capacity bandwidth as well as help member institutions to design, build or lease, operate, maintain, support and manage their physical telecommunication networks.

4. Opportunities for Innovation and Issues:

(a) Promote Global, Regional Links and Collaborations:

African countries need to encourage the promotion of global, national and regional research and educational networks and linkages to:

- Create economy of scale for building and sharing high speed networks;
- Contribute to inter-institutional collaboration, research and human networking;
- Promote joint institutional content development, access to large database and sharing of research results;
- Provide centralized training, capacity-building and advisory services to their member institutions.

(b) Address problems of energy generation in many countries of Africa

Connectivity has failed in many African countries due to the poor national power situations. Absence or lack of electricity in many countries limits ICT utilization for research.

(c) Leadership education:

There is need to promote and facilitate institutional leadership education on the management of ICT facilities. The institutional leadership will need to be educated on the need to standardize policies in network and service deployment.

(d) Improved funding for research:

For ICT to benefit research in Africa, there will be need for African countries and institutions to improve their funding for research. Current low financial commitment to research in Africa will not help to improve ICT connectivity for research.

Olusola Oyewole.