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Parallel Session 7D

Mathematics, Science, Technologies and Information and Communications Technologies in Post-Primary Education

Survey of ICT and Education In Africa (Vol. 1)

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The Commonwealth of Learning
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Working Document
Draft

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SURVEY OF ICT AND EDUCATION IN AFRICA

A Summary Report Based on 53 Country Surveys

Algeria • Angola • Benin • Botswana
Burkina Faso • Burundi • Cameroon
Cape Verde • Central African Republic
Chad • Comoros • Congo • Côte d'Ivoire
Djibouti • Democratic Republic of the Congo
Egypt • Equatorial Guinea • Eritrea • Ethiopia
Gabon • The Gambia • Ghana • Guinea
Guinea-Bissau • Kenya • Lesotho • Liberia
Libya • Madagascar • Malawi • Mali
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Mozambique • Namibia • Niger • Nigeria
Rwanda • Sao Tome and Principe • Senegal
Seychelles • Sierra Leone • Somalia
South Africa • Sudan • Swaziland
Tanzania • Togo • Tunisia • Uganda
Zambia • Zimbabwe

A DRAFT *info*DEV PUBLICATION PREPARED BY:

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ICT AND EDUCATION SERIES

SERIES EDITOR:
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Information for Development Program

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PREFACE

This study aims to bridge a crucial gap in our knowledge of the use of information and communication technologies (ICTs) in Africa.

Despite

- widespread beliefs that ICTs can be important potential levers to introduce and sustain education reform efforts in Africa;
- anecdotal evidence of increasingly widespread demand for and use of ICTs in education initiatives in African countries;
- demonstrated interest from African policymakers in using ICTs to help meet Education For All (EFA) objectives;
- scattered and often uncoordinated initiatives utilizing ICTs to benefit education throughout the continent; and
- much rhetoric related to the 'digital divide';
- there has been no consolidated documentation of what is actually happening in Africa in this area, nor comprehensive baseline data on the state of ICT use in education in Africa against which future developments can be compared.

A lack of information impacts planning
Anecdotal evidence suggests that many African countries and donor agencies are struggling to keep track of ICT/education projects over which they have "no control" and about which they often have little knowledge, making it unlikely that lessons learned from these projects can inform strategy and planning related to ICT use in education going forward. Many private sector firms and civil society organizations with an interest in supporting education programmes and technology initiatives in Africa (especially where such projects may intersect) have expressed similar frustrations.

A need for coordination
Conversations with colleagues at a number of organizations—donors, governments, civil society, universities, and the private sector— interested in ICT and education issues in Africa suggest that many have been contemplating similar or related types of data collection efforts in this area for some time. In order to accelerate such activities, *info*Dev has coordinated with a wide variety of groups to help support and consolidate the results from on-going data collection efforts and then share the resulting data as widely as possible. At a minimum, we hope that this survey process should help prevent duplication of efforts, as well as 'survey fatigue' on the part of potential information sources.

No consolidated information resource
Much relevant data collection has already occurred, but the results are scattered across a number of publications and databases (many of which are not widely known), held within individual organizations, not easily accessible to the education community, and/or, where public, not widely disseminated.

This *Survey of ICT and Education in Africa* seeks to gather together in a single resource the most relevant and useful information on ICT in education activities in Africa. We hope that this publication is a first step in a

larger, on-going, systematic, coordinated initiative to track developments in technology use in the education sector to help inform a wide variety of stakeholders interested in the topic as they seek solutions to larger, more fundamental educational and development challenges in the years ahead.

Michael Trucano
*info*Dev

REPORT LIMITATIONS

The following limitations should be noted:

- The *Summary Report Based on 53 Country Surveys* attempts to summarize key findings from the individual country reports produced during this project. As such, it is *not* an attempt to synthesize all that is known about ICT use in education in Africa, and should be seen as a guide to key findings and assertions that emerged during the country survey processes.
- The data presented in the individual *Country Reports* should be regarded as illustrative rather than exhaustive. This survey was not an exercise in primary data collection. The guidelines given to country researchers regarding report length were deliberate in order to ensure a focus on the more salient information and to enable the completion of the project within the established time frame and the available resources.
- ICT use in education is at a particularly dynamic stage in Africa, which means that there are new developments and announcements happening on a daily basis somewhere on the continent. Therefore, these reports need to be seen as "snapshots" that were current at the time they were taken; it is expected that certain facts and figures presented in the *Country Reports* may become dated very quickly.

PROJECT BACKGROUND

OVERVIEW

This report synthesises the findings from a survey that was initiated by the Information for Development Program (*info*Dev), a multi-donor partnership housed at the World Bank which investigates issues related to the effective and appropriate use of information and communication technologies (ICTs) in developing countries. The survey was undertaken in response to needs expressed by international donor and development agencies, private sector organisations, governments, and NGOs for a consolidated database of information focused on the following key questions:

- How are ICTs currently being used in the education sector in Africa, and what are the strategies and policies related to this use?
- What are the common challenges and constraints faced by African countries in this area?
- What is actually happening on the ground, and to what extent are donors involved?

A similar survey was completed in 2003–2004 by UNESCO-Bangkok (*Metasurvey on the Use of Technologies in Education in Asia and the Pacific*). It is hoped that this Survey will contribute to the building of a global database on ICT and education issues in developing countries, regularly updated with the co-operation of project stakeholders.

More complete background information on this project is available on the *info*Dev web site at http://www.infodev.org/ict4edu-Africa.

THE SURVEY PROCESS

A request for expressions of interest was issued by *info*Dev in April 2006. The Commonwealth of Learning (COL) was selected from among the respondents to conduct the survey, and the work began in September 2006.The work process was designed as follows:

- The first phase involved an extensive literature search to identify relevant extant information to inform the data-gathering process for the preparation of reports. The resulting English language bibliography was posted on the WikiEducator web site (http://www.wikieducator.org/ICT4EdAfrica) established specifically to solicit public feedback on the survey project.
- Researchers prepared reports on each country over a three-month period beginning January 2007. The reports were structured to include:
  - National policies, strategies, and programmes that exist in the country for the use of ICT in education
  - A brief description of the current level and types of ICT infrastructure being used in the various education sectors including primary, secondary, tertiary and non-formal
  - A list of the major initiatives underway
  - Identification and description of the factors that enable and constrain the use of ICT
- Data collection was largely done via desk research, using published sources on the Internet, and through

telephone and e-mail discussions with country-based contacts. This was supplemented by the personal knowledge and expertise of the ICT in education environment in the countries surveyed by regional and country researchers.

- The first drafts of all reports were posted on the WikiEducator web site during a public comment period from March–June 2007.
- Prior to the preparation of the final report, drafts of individual country reports and the related *Summary Report* were submitted to an *info*Dev review panel for comment.

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SURVEY HIGHLIGHTS

A NEW PHASE: FROM PROJECTS TO POLICIES

The process of adoption and diffusion of ICT in education in Africa is in transition. There appears to be the beginnings of a marked shift from a decade of experimentation in the form of donor-supported, NGO-led, small-scale, pilot projects towards a new phase of systemic integration informed by national government policies and multi-stakeholder-led implementation processes.

One of the primary features of this new phase is the priority that governments are giving to policy development. All but a handful of countries surveyed already have a national ICT policy in place or under development. While some of these national policies define goals and implementation strategies for ICT in the education sector, nearly half the countries have chosen to develop an ICT policy that is specific to the education sector. Thus the new phase of ICT for education in Africa is occurring within national, and emerging regional, policy frameworks that are providing the basis for partnerships and donor participation.

DIFFERENTIAL IMPLEMENTATION PROGRESS

While most countries have embraced policy development, there is a notable stratification in terms of their ability to implement. A country like South Africa, with its extant infrastructure and more mature economy, is clearly an outlier in terms of being able to implement its ICT in education agenda.

Many of the countries of North Africa constitute another stratum that has made excellent progress because of their resources and the high bandwidth connectivity they enjoy with Europe. Another group is made up of those countries that are moving steadily toward stable economies and that are placing a high priority on ICT applications. Cameroon, Ghana, Mauritius, and Botswana are examples.

The largest group is made up of those countries that are emerging from a period of conflict and authoritarian rule. They look to ICTs to assist them in their efforts to improve capacity for social and economic development. And, unfortunately, there remains a group of countries that are plagued with internal conflict and political instability that make progress on ICT for education impossible.

MACRO TRENDS

There are several trends evident in the country reports that appear to be important in terms of enabling implementation of ICT in national education systems.

Public-Private Partnerships

At the broadest level these are **multi-partnerships** that involve private companies (usually ICT based), one or more government ministries, educational institutions, donor and development agencies, and civil society organisations working together to garner resources and set priorities for ICT in education projects. The

Kenya ICT Trust Fund and the Egyptian Education Initiative are examples, as is the Information Society Partnership for Africa's Development (ISPAD) put together by NEPAD through the e-Africa Commission and five major ICT companies in part to implement the NEPAD e-Schools Demonstration project.

The number of **bilateral partnerships** between ICT organisations (e.g., Microsoft, Cisco, Intel, Hewlett Packard) and national ministries of education to enable use of specific ICT products has increased remarkably.

International partnerships, particularly in higher education, exist for a variety of reasons, including the development of ICT capacity. Two organisations that are particularly active are the Agence Universitaire de la Francophonie (AUF) and the Partnership for Higher Education in Africa that is sponsored by seven American foundations.

Digital Content Development

The need for digital learning materials relevant to local curricula is becoming more urgent as ICT becomes integrated into the teaching process across the curriculum. At national levels ministries are identifying institutional responsibilities and are beginning to encourage collaborative efforts on a regional basis. The AVOIR project is an example.

Open Source Software and Operating Systems

Interest in Free/Libre Open Source Software (FLOSS) is growing rapidlay in Africa. A constraint in some areas is the lack of skilled personnel available to support such systems. The Free and Open Source Software Foundation for Africa (FOSSFA), Bokjang Bokjef in Senegal, and LinuxChix Africa are examples of organisations promoting the use and development of FLOSS in Africa.

Regional Initiatives

A wide range of programmes and projects involve one or more African countries in varying numbers. Examples include high-level intergovernmental, multi-stakeholder programmes such as the NEPAD e-Schools Program, civil society institutions focused on networking African schools such as SchoolNet Africa (SNA), university partnerships such as the African Virtual University (AVU), and collaborative learning projects that directly involve learners and teachers from schools in several African countries such as the Global Teenager Project (GTP), Mtandao Afrika (MAf), World Links, and the International Education Resources Network (iEARN).

National Research and Education Networks (NRENs)

There are several examples of networks that enable connectivity among universities in countries in North, East, and Southern Africa that not only enable collaboration but allow for some cost sharing. Several of these NRENs have formed the UbuntuNet Alliance for Research and Education Networking with a view to becoming the research and education network (REN) backbone of Africa using optical fibre and other terrestrial infrastructure.

International Connectivity

Several initiatives are emerging to address the fact that Africa has long been disadvantaged by the lack of fast and affordable connectivity with the rest of the globe. One such initiative is the Eastern Africa Submarine Cable System (EASSy) project that is focused on developing an undersea fibre optic cable that will link the countries of East Africa to the rest of the world. Complementing this is the Africa Regional Communications Infrastructure Program (RCIP) that is focused on the terrestrial elements of the overall regional communications infrastructure. The RCIP initiative is financed by the World Bank. Many of the North Africa countries have had high-speed Internet connectivity with Europe for some time.

DANTE (Delivery of Advanced Network Technology to Europe), through its EUMEDCONNECT project, has developed a research network within the Mediterranean region that is providing high-speed connectivity for institutions in Mediterranean and North Africa countries with each other.

Wireless Networks

Wireless networks are developing at a rapid rate in most countries with the goal of facilitating general access to mobile phone technology and to broadband networks. Angola is an example of the latter, as it is upgrading its wireless network to help address growing nationwide demand for advanced wireless data services like telemedicine and Internet access.

DONORS

During the 1990s, international donor and development agencies like the International Development Research Centre (IDRC), the World Bank, UNESCO, UNDP, and USAID's Leland Initiative invested in grants for pilot projects to test the role of ICTs in promoting education and development. In a similar endeavour, the UK's Department for International Development (DFID) invested in regional programmes such as the Imfundo Project and (later) the Catalysing Access to Information Technology in Africa (CATIA) project. Since 1996, the UN Economic Commission for Africa, through its establishment of Partnerships in ICTs in Africa (PICTA), has also secured support from various donor agencies, particularly the European Union, for the development of what was at the time referred to as National ICT Infrastructure (NICI) plans for individual African countries. Bilateral partnerships between donor agencies and national governments have been instrumental in the promotion of ICT access and use in education institutions. Here the Swedish International Development Agency (Sida), USAID, and DFID have been particularly prominent in some African countries such as Tanzania, Namibia, and Ghana.

ENABLING AND LIMITING FACTORS

A 2006 survey on the state of ICT infrastructure in African universities summed up the situation regarding access to ICT infrastructure as "too little, too expensive, and poorly managed."[1] The country reports confirm this statement for all parts of educational systems. However, this situation is likely to change due to factors such as the emergence of policy frameworks, the evolution of networks, and, perhaps most importantly, the growing commitment to ICT in education on the part of government leaders.

ENLIGHTENED LEADERSHIP

The ICT in education developments and initiatives chronicled in the country reports are due to many factors, including the sustained efforts of a variety of organisations over the years. But it is also evident that the shift from "projects to policies," and the more systematic development that that implies, would not be possible without the growing commitment to ICT in education on the part of government leaders across the continent. The following comments are illustrative:

- **President Museveni of Uganda** at the launching of the NEPAD e-Schools project: *"This technology will enable the young people of this village to tap into the mainstream of information and knowledge, where they learn and play, expand their imagination and creativity, and collaborate with their peers across the African continent and across the world."*
- **Ms Elizabeth Ohene, Ghana's Minister of State for Education and Sports** at the opening of the first NEPAD e-school in Ghana: *"The computer should no longer be seen as a glorified typewriter, but as a tutor, an organiser, a presentation agent, a search agent, a data processor, a remedial and e-learning interactive agent."*
- **Prime Minister Meles Zenawi of Ethiopia** speaking to an ICT conference in Addis Ababa in 2005: *"We were convinced that we should invest every penny we have on securing the next meal for our people. We did not*

believe serious investment in ICT had anything to do with facing the challenges of poverty that kills. Now I think we know better. We recognise that it is a vital and essential tool for fighting poverty—for beating poverty that kills—and ensuring our survival."

- **Kenya's Education Minister Prof George Saitoti** speaking at the second International Conference on ICT for Development, Education and Training held in Nairobi, 2007: *"In education, the use of ICTs offers new ways in which the quality, effectiveness, and in particular, the flexibility of higher education can be improved. When integrated into education, ICTs have the capacity to improve the delivery of education through distance learning."*
- **African Ministers of Education**, meeting at the first African ministerial round table on ICT for education, training, and development in Nairobi on June 1, 2007, stated in their communiqué that: *"ICTs are seen as one key solution that will allow African countries to meet the needs in rural and under-served areas and bring education to their citizens rapidly and cost efficiently."* They also resolved that hundreds of thousands of teachers require ICT skills to help achieve this goal.

ICT POLICIES FOR EDUCATION IN AFRICA

GENERAL OBSERVATIONS

There is a great deal of variance in ICT policies for education among the African countries surveyed. South Africa clearly is unique in terms of being able to move its ICT agenda forward. Several of the countries of North Africa that have both resources and high bandwidth connectivity with Europe have also been able to make excellent progress implementing their ICT plans. Those countries that are steadily moving to sustainable economies (Mauritius, Ghana, and Botswana, for example) constitute another group making remarkable progress.

Perhaps the largest group is made up of those countries that are in transition from a sustained period of conflict and economic instability and are looking to ICT applications to help them meet myriad challenges—particularly the development of their human resource capacity. They are among the neediest in terms of assistance.

And, unfortunately, there remains a group of countries that are still plagued with political instability and internal conflicts that make progress on the ICT for education agenda impossible.

NATIONAL ICT POLICIES

The point that future socio-economic development will need to embrace the use of ICT appears to be widely recognised by governments throughout Africa and is evidenced by the number of countries that have a national policy for ICT in place or under development. The data in Table 1 below indicate how the development of these policies has progressed since the turn of the millennium.

The policies vary in several ways. First, a few, often those that have been in place for some time, are more likely to focus on telecommunication technologies and their regulation and less on the importance of information technologies for development (ICT4D). More typical, however, are the more comprehensive

TABLE 1: Development of National ICT Policies 2000–2007

Status of National ICT Policy Development by Country	2000*	2005*	2007**
Policy in place	13	28	36
Policy under development	10	15	12
No development underway	30	10	5
Total	53	53	53

* *Source*: UN Economic Commission for Africa (UNECA), http://www.uneca.org/aisi/nici/
** *Source*: ICT in Education in Africa Survey Reports

policies such as those developed in Botswana, Namibia, Zambia, and Libya. For example, Libya's policy focuses on:

- Supporting the government's initiatives on the Interim Poverty Reduction Strategy Program (iPRSP) using ICT
- Standardising ICT operational systems and administrative procedures
- Setting the framework to develop and implement ICT programmes in the counties and local communities
- Broadening the national academic curriculum to create careers in the ICT sector and raise overall awareness

Others, such as Mauritius, Zimbabwe, and Rwanda, are even more comprehensive. Rwanda, for example, focuses on the following 10 pillars:

- ICT in education
- Human capacity development
- Infrastructure, equipment, and content
- Economic development
- Social development
- E-government and e-governance
- Private sector development
- Rural and community access
- Legal, regulatory, and institutional provisions and standards
- National security, law, and order

EDUCATION SECTOR ICT POLICIES AND IMPLEMENTATION PLANS

Determining the status of development of ICT policies in the education sector was one of the primary objectives of the survey. The breakdown is as follows:

- Countries with sector ICT plan developed: 17
- Countries with sector ICT being developed: 7
- Countries with sector goals and strategies included in national ICT policy: 9
- Countries with sector goals and strategies referenced in other plans: 6

In the last instance, "other plans" include general education development plans, national poverty reduction strategies, telecommunication acts, national science and technology policy (Sierra Leone), and, in the case of Mali, the plans of a central implementing agency established to implement ICTs across all sectors.

There are several faces to the concept of ICT policy in the education sector. Obviously the most prevalent is a policy that has been developed by ministries of education. However, as noted above, education sector policies are often embedded in the country's national ICT policy, and, less obviously, in general policies on education development, the policies of the national telecom authority, or national poverty reduction strategies. Following are some specific observations:

- *ICT policies act as catalyst for ICT policy development in education*
  Of the 48 countries that either have a national ICT policy in place or are in the process of developing one, 39 of them have education sector ICT policies and plans in one form or another or are in the process of developing them. Clearly the development of national ICT policies acts as a catalyst for ICT policy development in the education sector. In fact in some cases (e.g., Botswana, Rwanda) the development of goals and implementation plans for the education sector has been an integral part of the larger process of developing the national plan.

Two exceptions to this generalisation are Eritrea and Equatorial Guinea, which do not have a national ICT plan. Eritrea has nevertheless proceeded to develop its education sector policy, and Equatorial Guinea has taken a partial step by passing a law legitimising and encouraging the use of distance education.

- *Most ICT education sector policies developed since 2000*
  With some exceptions (such as South Africa and Mauritius) the ICT education sector policies have been developed since the turn of the millennium. One gets the sense of a general renaissance having occurred in ministries of education across the continent, particularly over the last five years.
- *ICT policy development for education is a long and complicated process*
  It is also the case that the process of developing an ICT policy for education is complicated. In many instances the policies that have been recently promulgated are the result of several years of consultation with stakeholder groups.[2]
- *Most ICT/education policies are comprehensive*
  Most policies include all the sub-sectors of the education system. However, a few, such as South Africa and Kenya, are specifically focused on the school sub-sector.
- *All ICT/education policies stress enhancing access, some go further*
  All policies surveyed emphasise the importance of enhancing access to ICT tools and Internet connectivity, developing ICT skills among young people and the general population, and the importance of teacher training. However, the policies of some countries are even more comprehensive in that they also stress the need for the development of digital content, education portals, and the need for content in indigenous languages.
- *Donors play an important role in the policy process*
  The international donor community (e.g., UNECA, USAID, UNDP, AfDB, IDRC) continues to play an important role in the policy development process, and the impact is seen in many plans in terms of the detail which purposes, outcomes, performance indicators, monitoring and evaluation strategies, and implementing strategies are set out. The plans developed by South Africa, Kenya, Mauritius, and Rwanda are exemplary in that respect.
- *ICT/education plans aren't always implemented*
  The development of plans doesn't necessarily equate with implementation and results on the ground. In most cases implementation remains very dependent on the support of partners from the donor community and the private sector. Indeed, some countries have set up mechanisms specifically to attract investment in the development of ICT in education and through which to involve stakeholders in setting priorities and allocating resources. The Kenya ICT Trust is an example.
- *ICT/education policies typically articulate a vision, while implementation plans focus on the practical*
  For many counties the ICT sector policies constitute a vision for development whereas their implementation plans need to focus on the practical and sustainable initiatives that can be taken in the shorter term to move towards the vision. For this reason, several countries (e.g., Rwanda) have developed their implementation plan in five-year increments over 15 or 20 years. An interesting example of a pragmatic approach to policy implementation is Cape Verde which has developed a plan that contains a comprehensive list of needs but, faced with a woeful lack of ICT infrastructure, is focusing on the use of radio to provide support for teachers and enriched content for students.

POLICY MANAGEMENT

The models for managing the maintenance and implementation of ICT education sector policies were of specific interest in the survey. In virtually all countries surveyed, there is a government-wide steering committee that oversees the implementation of ICT policy generally, negotiates with funding partners, and recommends on priorities and annual budget allocations. Beyond that however, there is a great deal of variance as indicated in the following comments:

- *Decentralised approach*
  Countries that decentralised or shared responsibility with states/provinces for education, such as Nigeria

and South Africa, have mechanisms in place to manage and implement policy at that level; states/provinces have their own specific ICT in education policies with appropriate mechanisms for implementation and management.

- *Centralised approach*
  Countries that have adopted a more centralised approach to policy development have opted to create a new agency with a mandate to implement the policy across all sectors. Namibia, Mauritius, Botswana, and Rwanda are examples.
- *Quasi-decentralised approach*
  Uganda is an example of a ***quasi-decentralised approach*** to policy management: the line ministries develop their sector policies and plans, with their progress and performance being monitored by a central agency designated by government to ensure implementation of the national plan at the sector level.
- *Ministry of Education role*
  More common, however, is the model whereby the Ministry of Education, sometimes in association with the ministry responsible for telecommunications, takes responsibility for policy development and implementation. Typically the ministry will have established an ICT unit, staffed with the necessary expertise, to act as the locus of responsibility for managing the implementation of the policy.
- *Varied stakeholder involvement*
  An important variable in these models is the amount of stakeholder involvement in the process. In some instances the process is more top down with limited stakeholder involvement. But more often, the sector policy has evolved through an extensive process of discussion with stakeholder groups including civil society, educators, private sector, the donor community, intra-ministerial departments, and other ministries of government. In these instances the management model tends to reflect the process of policy development in that stakeholder involvement is maintained through a ministry-led steering committee that ensures co-ordination and advises the ministry on priorities and implementation strategies—which may include agreed-upon implementation roles for stakeholders such as NGOs. Examples are found in Kenya, Namibia, and Ghana.

ICT INFRASTRUCTURE FOR EDUCATION IN AFRICA

GENERAL OBSERVATIONS

Most countries surveyed have, or are in the process of, liberalising their telecommunications policies to enable more competition and diversity of service providers in the industry. While this is having the effect of lowering the cost of access to information and telecommunication infrastructure, the *costs of connectivity remain unaffordable* for most education institutions. Furthermore, there are *huge gaps between urban and rural areas* in terms of access to ICT infrastructure.

Access to a reliable supply of electricity is a general problem but is particularly severe in rural areas because of the difficulty of connecting to national electrical grids. There is a general lack of human resource capacity to provide ICT training and equipment servicing, and there is also a lag between the availability of ICT infrastructure and the ability of agrarian societies to integrate it to benefit national development. Djibouti, for example, is at the forefront with a digital telecom network with two earth stations and the landing point for three undersea cables linking to Asia, the Middle East, and Europe. However, the country has yet to develop an ICT education sector policy and has generally not yet benefited from these assets.

Nevertheless, the *Country Reports* describe myriad initiatives that demonstrate that rapid changes are underway—and that there are many instances where this generalised picture does not apply:

- The availability of mobile phone technology is increasing at a remarkable rate.
- Wireless networks are becoming increasingly common.
- Undersea cable projects such as the EASSy project are being planned to provide global connectivity for countries that currently lack such access.
- A variety of public-private partnerships are emerging, particularly in the form of ICT trusts designed to encourage investment and stakeholder participation in ICT infrastructure development in education. (See the country reports for Kenya, Namibia, and Sudan for examples.)
- In the national ICT policies of several countries (notably Rwanda, Mauritius, Algeria, and Botswana), there is a declared intention to become a regional ICT service hub.

However, it is worth noting that, with the development of ICT infrastructure, comes the problem of *e-waste*—electronic or electrical equipment that has been discarded or has become obsolete. This includes old, end-of-life computers, cell phones, TVs, and radios. E-waste is reportedly one of the fastest growing forms of waste around the world. The United Nations Environmental Program has estimated that up to 50 million metric tons of e-waste are generated every year. Recently, the United Nations has called for policies to protect African countries from unregulated imports of e-waste.[3]

Schools and universities across Africa have experienced significant use of second-hand and *refurbished PCs* obtained from groups like Computer Aid International, Digital Links, and World Computer Exchange. This has led to the establishment of local PC refurbishment and technical service centres in a few African

countries. In addition, a very limited number of initiatives and groups have been established in Africa to recycle e-waste products and develop strategies to raise awareness about them. In South Africa, the Information Technology Association has partnered with the Swiss State of Economic Affairs and the e-Waste Association of South Africa to play a leading role in developing an effective e-waste model for the country.[4]

INFRASTRUCTURE IN HIGHER EDUCATION

With the exception of South Africa, Mauritius, and most of North Africa, African universities are seriously constrained in the use of ICT by a lack of computer stations and a lack of access to affordable high-speed Internet connectivity. Indeed, the 2006 African Tertiary Institutions Connectivity Survey (ATICS) summed up the situation as "too little, too expensive, and poorly managed." The survey report goes on to say that "the average African university has bandwidth capacity equivalent to a broadband residential connection available in Europe, [and] pays 50 times more for their bandwidth than their educational counterparts in the rest of the world."[5]

These challenges are being addressed through the development of *national research and education networks* (NRENs) that, at national levels, will enable connectivity among universities and, eventually all educational institutions. Examples include Morocco's X.25 Gateway which connects 14 universities to the Internet, the national network of education and research (RENER) in Burkina Faso, and Libya's higher education and research network (LHERN) that connects universities and other institutions. Other NREN examples are described in the reports for Botswana, Djibouti, Kenya, Malawi, Mozambique, Namibia, and Rwanda.

The expectation is that by linking these networks to undersea cables via regional networks, global connectivity will be a reality and costs can be reduced to sustainable levels. The Eastern Africa Submarine Cable System (EASSy) project and the Africa Regional Communications Infrastructure Program (RCIP) project are examples of these initiatives.

The NREN linking initiative is also being led by the UbuntuNet Alliance that has been established to provide a research and education backbone for Africa based on the emergence of optical fibre and other terrestrial infrastructure opportunities.[6]

Another example of the development of global connectivity networks is the DANTE (Delivery of Advanced Network Technology to Europe) initiative, through its EUMEDCONNECT project, that has developed a research network within the Mediterranean region providing high-speed connectivity for institutions in Mediterranean and North Africa countries.

Wireless networks are emerging as a cost-effective way of establishing connectivity among and within in higher education institutions. The report on Guinea cites an example where the primary universities have created wireless networks to link their central campus with their several remote campuses.

Universities are also developing their own internal ICT policies. Many of the South African universities are examples, with several having policies on the manner in which ICT is expected to be integrated into the teaching/learning process. Others have policies on the management of ICT functions. Stellenbosch University has an "e-campus" strategy encompassing all related activities, and the University of Pretoria has a Telematics Learning and Education Innovation plan.

The African Virtual Open Initiatives and Resources (AVOIR) project is a collaborative effort involving higher education institutions from Kenya, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania, and Uganda in the development of products and expertise in free and open source software. One of the products developed and deployed among the institutions is KEWL.Nextgen e-learning platform.[7]

INFRASTRUCTURE IN SCHOOLS

African Ministries of Education have begun to be more proactive in co-ordinating and leading the development of ICT infrastructure in school systems as their ICT policies and implementation plans have taken shape. However, civil society, principally NGOs working with donor agencies, continues to play a major role in providing computers to schools and lobbying governments to take a leading role. That said, their efforts have been frustrated by the lack of connectivity, inconsistent electrical supply, and lack of technical support services—particularly in rural areas. The ICT policies place a great deal of emphasis on providing ICT infrastructure to secondary schools and, eventually, to primary schools as well. But implementing these policies and plans will require time and major infusions of resources.

The country reports highlight to a number of phenomena:

- *Student fees*
  One of the ways schools try to provide sustainable access to ICT infrastructure is to assess additional student fees. While this may be manageable in some contexts, the practice is widely criticised as discriminatory for those who can't afford it.
- *Using 'old' technologies*
  The reports for Guinea, Togo, and Djibouti provide examples of how "old" ICT technologies are being used to support teachers and students. Guinea has a radio-based National Distance Teaching Service that uses radio broadcasts, audiocassettes, and print materials that are produced by the National Institute for Pedagogical Research. The project is supported by USAID. Togo uses an FM radio network to provide supplementary curriculum content for teachers, and Djibouti has a school radio broadcast for secondary schools focused on math and science content.
- *Satellite-based networks*
  Egypt has a seven-channel satellite-based network with receive centres in schools and administrative centres, plus mobile centres that provide support for remote schools in the areas of primary, preparatory, secondary, and technical education plus languages and general knowledge. There are also channels dedicated to upgrading teachers and for literacy programmes.
- *Low-cost computing pilots*
  A number of pilots on low-cost computers in schools are emerging. These include the One Laptop per Child (OLPC) project that involves the distribution of a $175 laptop made of tough white and green plastic, and which has a four-hour battery, a colour screen, and built-in Wi-Fi. OLPC is currently running pilot projects in South Africa and Nigeria.

INFRASTRUCTURE FOR NON-FORMAL EDUCATION AND THE GENERAL PUBLIC

Public access to ICT is available to various extents in most of the larger urban centres in Africa through cyber cafés, but access is largely non-existent in rural areas. Most of the national ICT policies in Africa identify the need to provide access for the general population as an essential ingredient for development. A common strategy for doing so is the establishment of local centres that provide access to computers and Internet connectivity, and often to TV and peripheral services such as printing, cassettes, and DVD players. Training and information dissemination activities related to ICT, literacy, health, markets, and government services are often part of the operations of such centres. The following are illustrative of examples in the reports:

- Madagascar is establishing "ICT villages" with a digital classroom, health centre, and community ICT access.
- Mozambique has community multimedia centres resulting from a merger between existing telecentres and some radio stations.

- Mauritius uses a fleet of "cyber caravans" to take ICT facilities to remote areas.

However, as far as non-formal education is concerned, the predominant infrastructure used is still the "old" technologies of radio and television.

ICT ACTIVITIES AND INITIATIVES IN HIGHER EDUCATION IN AFRICA

TECHNICAL/VOCATIONAL EDUCATION AND TRAINING

As used here, the term higher education refers to both universities as well as post-secondary institutions that provide technical and vocational (TVET) programmes. However, in terms of ICT applications, the conclusion from the reports is that there has been relatively little application of ICTs in the TVET sub-sector either as a teaching tool or to enhance access to programmes. The conclusion is corroborated in a statement by the Commonwealth of Learning (COL) and the Commonwealth Association of Polytechnics in Africa (CAPA) in advance of a seminar they co-sponsored in Sierra Leone in May 2007 that focused on integrating ICT and e-learning into TVET:

> *Although ICT and e-learning is gaining ground as an effective pedagogical tool in higher education, TVET institutions and polytechnics in Africa are lagging behind. The reason appears to be lack of knowledge and expertise in the use of these new technologies in the area of technical and vocational training, and the absence of institutional and country policies on the integration of ICT and e-Learning into TVET.*

The point is further supported by the fact that the first-ever TVET summit was held prior to the Second International Conference on ICT for Development, E-learning and Training held in Nairobi in May 2007. This summit was organised by UNESCO-UNEVOC and focused on access to and inclusion in TVET in Africa through new ICT-based solutions.

UNIVERSITIES

Generally speaking, the capacity of African universities to lead the process of integrating ICT in education, as has been the case in most of the developed world, is woefully inadequate. They lack access to infrastructure, affordable and sufficient bandwidth, and the human resource capacity to exploit the technology. (These constraints are summarised in more detail in another section of this report.) As a result, African universities are lagging behind in the global ICT context. The exceptions are universities in South Africa, and most of those in North Africa, where they have well-developed international relationships along with access to high-speed connectivity.

The Association of African Universities states that the development and application of ICT in African higher education institutions is critically important if the continent is to reduce the knowledge, technological, and economic gaps between itself and the rest of the world. The survey reports indicate that this is starting to happen, as the following points illustrate:

- With some exceptions (such as Kenya), universities are typically included in the ICT policies that have been developed. In instances where they have not they are urged to develop their own ICT policies.

- Institutional policy development is being supported by the Association of African Universities, by regional bodies such as the Inter-University Council for East Africa, and through a growing number of partnerships with foreign universities in North America, Europe, Australia, and, more recently, India.
- It is notable that governments are looking to their primary universities as the nodes for leadership in implementing national ICT policies as well as those in the education sector. Makerere University in Uganda and the National University of Rwanda are examples.
- Africa has largely not seen the influx of for-profit, ICT-based foreign providers of higher education seen in others parts of the world. However the interactions, collaborations, and partnerships between African and foreign universities are increasing—many of them enabled by ICT and by a resurgence of donor interest in higher education.
- There are two international organisations that deserve special mention because of their work in fostering innovative ICT applications. One is the Agence Universitaire de la Francophonie (AUF), which is extremely active in facilitating partnership arrangements between African francophone universities and ones in France, Canada, and other parts of the French-speaking world. The other is the Partnership for Higher Education in Africa, an initiative supported by seven major foundations in the US with the objective of accelerating the processes of comprehensive modernisation and strengthening of universities in selected countries in Africa. One of the Partnership's seven major goals focuses on the use of ICT.
- While not exclusively focused on ICT, the Development Partnerships in Higher Education programme (DELPHE) initiated by the UK Department for International Development (DFID) is likely to result in a number of projects that aim to enhance the ICT capacity of universities. The programme provides support for partnerships between higher education institutions in the UK and those in participating countries in Africa working on collaborative activities related to the MDGs.[8]
- Three Rwandan universities (the National University, the Kigali Institute for Education, and the Kigali Institute for Science and Technology) and the University of Nairobi have partnered with Google to improve access to Web-based communications for staff and students. This will allow free access to Google applications.[9]

DISTANCE EDUCATION AND e-LEARNING IN HIGHER EDUCATION

Traditional print-based distanceducation, assisted by radio and TV, is not new to many parts of Africa, particularly South Africa, Mauritius, and Tanzania, and print remains the predominant delivery tool for distance education in Africa, as the incorporation of the more modern ICTs in the process is constrained by a lack of infrastructure and affordable connectivity in many parts of the continent. Nevertheless, there are numerous examples of innovative applications of ICT in distance education strategies with the result that the terms "e-learning," "virtual universities," "open universities," and "virtual schools" are appearing in policy and planning documents. The country reports cite numerous examples of the growing adoption of ICTs across the continent:

- The rate of adoption is extremely variable. A 2003 survey commissioned by the Association for the Development of Education in Africa (ADEA) Working Group on Distance Education and Open Learning found that while the Internet and CD-Roms were used in 35% of francophone institutions, only 5% of anglophone and 0% of lusophone institutions were using them.[10] These results are somewhat skewed by the fact that universities in North Africa enjoy much better connectivity with Europe.
- The work of the AUF is also influencing ICT adoption in francophone institutions. For example, the AUF has created a centre in Lomé, the capital of Togo, that serves four higher education institutions with 50 computers and high-speed connectivity that enables students to take e-learning courses from institutions throughout the francophone world. This model has been replicated in several other francophone countries in Africa.
- The African Virtual University (AVU) has established more than 30 learning centres through its partnerships with higher education institutions in 19 countries offering a variety of courses with a primary emphasis on teacher training and upgrading.

- The reports for Libya, Morocco, Sudan, and Tunisia all cite the development of virtual or open universities with the one in Sudan being specifically focused on teacher training. The Moroccan Virtual Campus works with Moroccan universities to enhance access for students.
- The University of Mauritius has established a centre for lifelong learning that includes a centre for distance education and another one for innovative learning technology.

CONTENT DEVELOPMENT

At this juncture it appears that less attention is being paid to the development of digital learning materials in higher education than to the schools sub-sector. This is perhaps not surprising, given that the lecturer in the university classroom has always had far more independent control over content than the teacher in a school classroom. Most of the effort to enhance access to content in universities is focused on gaining access to affordable, high-speed Internet connectivity for faculty and students rather than on developing materials at the institutional level, or through collaborative partnerships among universities or countries. Egypt, however, has an ICT project that designs e-learning courses and has established a digital library that serves all universities.

Another interesting development is the COL-led Virtual University for Small States of the Commonwealth (VUSSC) project that aims to create post-secondary skills-related courses in areas such as tourism entrepreneurship, professional development, disaster management and a range of technical and vocational subjects.[11] These courses are being created under Creative Commons copyright using WikiEducator, which enables the materials to be readily adapted to the specific context of each country and used in the offering of credit-bearing qualifications in the countries' post-secondary institutions. The participating African countries are Botswana, Comoros, The Gambia, Lesotho, Namibia, Seychelles, Sierra Leone, and Swaziland. Staff from selected universities in those countries are being trained to develop content for inclusion in the database.

ICT ACTIVITIES AND INITIATIVES IN PRIMARY AND SECONDARY SCHOOLS IN AFRICA

GENERAL OBSERVATIONS

The formal schools sector has historically led the way on ICTs in education in most African countries, often before national policies have been adopted. South Africa, Namibia, Senegal, Mali, Cameroon, Nigeria, Ghana, Kenya, and Uganda are a few examples. In these cases, the initiation of ICT access in schools has been supported by large programmes like the World Bank's World Links for Development, which worked mainly in partnership with ministries of education, SchoolNet Africa, and the IDRC's Acacia programme. These initial small-scale projects have been taken to the next level by national programmes that are promoting ICT access to all schools. Much of the emphasis is on secondary school access in almost all countries.

A salient feature of national ICT and ICT for education policies in a number of African countries is the promotion of computer science or information technology as a school-based subject in addition to the access, use, and integration of ICTs within the school systems. Botswana, Mauritius, Seychelles, South Africa, and Zambia are countries that have taken such promotion on. The inclusion of schools in national education management and information systems within ministries of education is an added feature of national ICT for education strategies in countries like Botswana and South Africa.

EQUIPMENT AND CONNECTIVITY

All African countries with national policies on ICTs in education make detailed and specific reference to issues of universal ICT access and use in all formal schools. Botswana, Ghana, Kenya, Namibia, South Africa, and Zambia are examples. These programmes have been given further impetus by high-level pan-African programmes such as the New Partnership for Africa's Development (NEPAD) e-Schools Initiative, which is concluding its first phase Demonstration Project involving 16 African countries. In Lesotho, this initiative catalysed national interest at the highest level of government.

Table 2 illustrates the range of technologies being used to provide connectivity in some form.

The country reports highlight the following trends:

- *Computers labs in schools*
  The dominant ICT access model in schools is the computer lab, involving between one and 40 computers, most of which are networked either by thin client or fat client, although some are standalone PCs as in Mali and Cameroon. These computers are used both for administration as well as support tools to aid teaching.

TABLE 2: Access and Connectivity Models

Technology/Connectivity	Project and Country
Radio	OLSET (South Africa), KIE (Kenya)
Television broadcast	Mindset (South Africa), Learning Channel (South Africa Talk Back TV (Botswana) Ethiopian Ministry of Education Centre for Technology Development and Decisionmaking Support (Egypt)
Video	Discovery Channel Global Education Fund (Angola, Tanzania, Uganda, Zimbabwe)
DVDs and CDs	Learnthings Africa, CurriculumNet Uganda, Mindset (South Africa)
Second-hand PCs	Schoolnets in Cameroon, Mali, Mozambique, Namibia, Nigeria, Senegal, Swaziland, Zambia Zimbabwe
PC refurbishment centres	SchoolNet Africa and GEEP(Senegal), World Links (Zimbabwe) Computers for Schools Kenya, SchoolNet Uganda, Computer Education Trust (Swaziland), SchoolNet Namibia
Dial-up Internet	SchoolNet Cameroon,
Satellite datacast	Mindset (South Africa)
Broadband Internet	Mauritius Ministry of Education and Ministry of IT
VSAT connectivity	SchoolNet Uganda, NEPAD e-Schools (Mali, Uganda, Rwanda)
Mobile phones	Teacher SMS Project (Kenya), Math on MXit, Meraka Institute (South Africa); M-Girls, Mindset (South Africa)
Open source software	OpenLab (SchoolNet Namibia); SchoolNet Mozambique

- *Television*
  Some countries have used television broadcast as a medium for delivery of education content, as is the case with Mindset Network and the Learning Channel in South Africa, the Talk Back TV on HIV/AIDS programme in Botswana, and the Centre for Technology Development and Decision-making Support in Egypt. In Ethiopia, classrooms are equipped with plasma screens and already receive lessons via video broadcast for eight hours a day by satellite TV. Multichoice Africa has also supported access to a range of educational channels which include National Geographic, the Discovery Channel, the History Channel, and Mindset Learn via satellite broadcast in a number of African countries via its own programme as well as the NEPAD e-Schools Demonstration Project.

  Organisations like the Discovery Channel Global Education Fund have provided television, video, and education content resources to small numbers of schools in countries such as Angola, Tanzania, Uganda, and Zimbabwe.
- *Radio*
  Organisations like the Open Learning Systems Education Trust (OLSET), based in South Africa, developed audio- and print-based distance education programmes for direct use in classrooms. Interactive radio instruction has also been used extensively by organisations like the Kenya Institute of Education, which has a radio broadcast studio and which has reached up to 400 schools via satellite radio in partnership with WorldSpace.
- *Used computers*
  Many countries have used second-hand and refurbished PCs sourced from groups like Computer Aid International, Digital Links, SchoolNet Africa, and World Computer Exchange. Schoolnet organisations in Cameroon, Mali, Mozambique, Namibia, Nigeria, Kenya, Uganda, Zambia, and Zimbabwe have

sourced second-hand and refurbished PCs and have imposed minimum specifications when obtaining the PCs. In these cases organisations like SchoolNet Namibia, SchoolNet Mozambique, World Links Zimbabwe, SchoolNet Nigeria (in partnership with organisations like the Education Tax Fund), Computers for Schools Kenya, and SchoolNet Uganda have established PC refurbishment centres or technical services centres that support the deployment of computers, maintenance, and support to schools.

- *VSAT*
  Some countries have experimented with very small aperture terminal (VSAT) solutions that enable remote access through the use of satellite and help overcome limitations imposed by vast distances and rugged terrain. SchoolNet Uganda initiated a pilot with 11 schools in 2001 that brought some benefits but that also proved expensive and unsustainable. The private sector consortia in the NEPAD e-Schools Demo Project promoted VSAT solutions in some countries such as Mali and Senegal.
- *Electricity*
  Lack of access to electricity, especially in rural schools, is an added challenge that some countries have confronted. For example, SchoolNet Namibia piloted the use of solar panels in schools. In Nigeria schools have invested in generators to accommodate regular power outages. The NEPAD e-Schools Demo Project also made use of generators in Uganda.
- *Mobile phones*
  More recently, mobile phones have been used for learning in South Africa with the piloting of the Math on MXit and MobilEd programmes by the Meraka Institute. In Kenya the use of short message system (SMS) among teachers has also been tried.
- *Multi-channel learning*
  Organisations like Mindset Network in South Africa have introduced a multiple platform approach in the distribution of its locally produced electronic education content to schools. These include satellite broadcast and satellite datacast which accommodate video on demand, content servers networked to PCs, DVDs, the Web, and more recently, mobile devices.
- *Open source*
  Almost all countries surveyed have made use of both open source and proprietary software solutions. In South Africa, even though the government supports open source software, it also has an agreement with Microsoft that promotes free Microsoft software for all schools. This agreement will be under review shortly. SchoolNet Namibia has been in the forefront in promoting FLOSS in schools through the promotion of its OpenLab model
- *Internet access*
  Many schools that do have computers still do not have access to the Internet. The Internet can provide a wealth of learning resources that many African schools at present are not yet able to access because the cost is prohibitive. In South Africa, for example, of the estimated 6,000 schools that have access to PCs, only an estimated 2,500 have Internet access.

  Connectivity solutions include legislation promoting an e-rate that offers discounted access to the Internet for schools, even though in some countries (e.g., South Africa) such legislation has faced implementation challenges. In Lesotho, the Ministry of Education has negotiated, at least in principle, Internet access to schools at reduced rates. In Senegal, Sonatel makes discounted Internet access available to schools, and in Namibia, an agreement between SchoolNet Namibia and Telecom Nambia provides 24/7 flat rate access to all schools.

  Some countries have begun the evolution to broadband access that also supports schools. Mauritius is considered a "cyber island" in this context as 90% of the island to date can be considered a "hot spot" with wireless Internet access. In Ethiopia, the Ethiopian Telecommunication Corporation and a host of partners established a state-of-the-art multimedia broadband backbone infrastructure with a core nucleus of 4,000 kilometres of optical fibre. This same network has provided a backbone for the first phase of the schoolnet initiative in that country.

Table 3 below provides some estimates of numbers of schools reached with computers in a sample selection of African countries. Notably, the NEPAD e-Schools project has targeted the reach of Africa's full comple-

TABLE 3: Computer Penetration Ratios at Schools in Selected African Countries, 2006

Country	Number of schools	Schools with computers	Percentage schools with computers
Egypt	26,000	26,000	100%*
Ghana	32,000	800	2.5%
Mozambique	7,000	80	1.1%
Namibia	1,519	350	22.1%
South Africa	25,582	6,651	22.6%

*Based on figures obtained from the Ministry of Education in Egypt, 2006.

ment of formal schools—estimated at 600,000—which has been factored into its recently developed business plan.

TEACHER PROFESSIONAL DEVELOPMENT AND TRAINING PROGRAMMES

Research conducted by SchoolNet Africa, the Commonwealth of Learning, and the International Institute for Communication and Development (2004) identified an estimated 61 different ICT-related teacher-training and professional development programmes, projects, and courses under way in Africa. Since then, additional national and regional teacher professional development programmes have emerged. It is difficult to estimate the numbers of teachers with access to ICTs and who have been trained in their use for learning and teaching.

Most countries surveyed have had some investment in developing the capacity of teachers to use ICTs as a teaching and learning resource through both in-service and pre-service programmes. Most teacher-training programmes in Africa involve the development of basic ICT skills, sometimes as an end in itself, although in some cases these include the application of ICTs as a learning tool for teachers.

Teacher training often involves one-off, topic-led, short-term training programmes that aim to develop specific skills of teachers, but which do not necessarily comply with professional standards of competency development. Training programmes run by Mtandao Afrika and the Global Teenager Project are among these. However, the systematised, initial, continuous, coherent, and modular process of professional development of African educators in accordance with professional competency standards and frameworks is making its way in many African countries through the use of ICTs.[12]

UNESCO's Teacher Training Initiative for Sub-Saharan Africa (TTISSA) and the African Virtual University (AVU) Teacher Education Project feature among the most significant, multi-country regional programmes promoting teacher professional development and ICT integration. TTISSA is a high-priority programme on teacher professional development in Africa scheduled for 2006–2015 with a focus on supporting the 46 sub-Saharan countries on restructuring national teacher policies and teacher education. Its main aim is to increase the number of teachers and to improve the quality of teaching in Africa, and it considers the use of ICTs as a strong component of the programme. The AVU established an ambitious teacher education project which involves 10 African countries in partnership with the African Development Bank (AfDB) and the New Partnership for Africa's Development (NEPAD) in 2006. The programme focuses on mathematics and science education and the integration of ICTs in and across the teaching of the curricula in these two subject areas. The intention is to contribute to the growth of more and better quality teachers through the use of flexible, open, distance, and e-learning methodologies at an affordable cost for diploma, undergraduate, and graduate levels. The specific objectives of the project are to enhance the capacity of teachers in the

use of ICTs in teaching and learning of mathematics and science, to develop the capacity of teachers to deliver ICTs as a subject in secondary education, and to increase the number of mathematics and science teachers by expanding access to training through the open, distance, and e-learning methods.[13]

The Educator Development Network of SchoolNet South Africa is a good example of an on-line learning model that includes introductory training, materials comprising 20 different modules, virtual communities of up to 20 teachers, mentor support for groups and individuals, tracking and archiving through an established database, a Web portal of resources for teachers, and recognition of teacher progress by means of a certificate of completion for those teachers who complete six introductory modules and credits towards an Advanced Certificate of Education offered by the University of Kwazulu Natal.

A recent development is South Africa's plan to introduce a dedicated Advanced Certificate of Education model on ICT integration that will be delivered by its higher education institutions and that will be compulsory for school principals.

Whilst many teacher professional development and training programs in Africa focus on in-service teachers, there is also a shift towards the inclusion of pre-service teacher development on ICTs in education. Tanzania's attempt at linking *all* its teacher training colleges for this purpose is a case in point.

The e-Africa Commission that manages the NEPAD e-Schools initiative has also developed a comprehensive conceptual framework for teacher training and professional development in Africa.

CONTENT DEVELOPMENT

The local development of indigenous digital or electronic education content in Africa is very limited. Within a formal school education context, this often refers to the development of digital curriculum content aligned with or directed by national curriculum frameworks. In addition to print-based media, there are also examples of the use of video, audio, and computer-based multimedia formats.

- *Audio*
  In Kenya, the development of audio-based curriculum content is widespread under the leadership of the Kenya Institute of Education. This role is also played by the Open Learning Systems Education Trust in South Africa, which produces audio content for use by teachers in a number of African countries.
- *Video*
  In South Africa, Mindset Network and the Learning Channel specialise in the development of curriculum-aligned video content in a range of subject areas offered in South African schools. In Botswana, the Mochudi Media Centre also trains teachers in the development and use of video content.
- *Multimedia content*
  There is a growing trend towards the development of curriculum content in multimedia format. In Uganda, the work of CurriculumNet, a project of the National Curriculum Development Centre in partnership with the International Development Research Centre, invested in the development of local, digitised curriculum content in school-based subjects like mathematics in multimedia format. Organisations such as Learnthings Africa specialise in the development of multimedia content in a range of subjects that have been used extensively in the NEPAD e-Schools Demo Project in a number of countries. Similarly, Mindset Network in South Africa has developed multimedia content directed by South Africa's National Curriculum Statement in new subjects like information technology for both primary and high school.
- *Local content development*
  The need to develop local digital content is recognised in most of the ICT education sector policies. Several policies specify the agency to assume responsibility for this role. Typically an existing agency that previously had the responsibility for developing print-based curriculum materials assumes this function.

This plan may be problematic unless it is accompanied by an intensive staff development programme in designing materials for e-learning.

- *Localisation*
  In the absence of expertise and capacity to develop indigenous content, there have been attempts at re-versioning content produced for an international audience and localising it for use at local level. The Skool.Com project of Intel is a case in point where multimedia content has incorporated local examples in an attempt to promote contextual relevance.
- *International content*
  Short of producing content locally or localising content produced elsewhere, there has also been a tendency to adopt international content for use in African classrooms. National Geographic and the Discovery Channel are good examples. The Discovery Channel Global Education Fund has promoted the use of Discovery content in countries like Zimbabwe and Angola; in the latter, content has been made available in Portuguese. The importation of content of this nature appears to be a growing trend.
- *Learning objects*
  In addition to the design and development of digital curriculum content, the systematic codification, storage, and management of digital education content is also a growing issue in Africa. The concept of "learning objects" has been introduced, referring to learning resources that can be used for intended learning outcomes and reused in a range of learning environments.[14] The African Virtual University has partnered with the Commonwealth of Learning in the development of an African Learning Object Repository.
- *Intellectual property*
  Digital content has either been produced as proprietary content, which is often copyrighted, or licensed under the Creative Commons, which allows for a range of options to render it free and open for adaptation. The establishment of the African Digital Commons to promote Creative Commons is a recent phenomenon that has been established as part of a growing trend towards open education resources. Open educational resources include learning objects such as lecture material, references and readings, simulations, experiments and demonstrations, as well as syllabuses, curricula, and teachers' guides.[15]
- *Education portals*
  The establishment of education portals has also been a feature of learning management systems. The South African Department of Education established its Thutong portal as a gateway for aggregating learning objects and resources for use by South African teachers.

COST MODELS

The promotion of total cost of ownership (TCO) models has become increasingly popular for ICTs in education in the schools sector. Key examples include:

- research supported by CATIA:
- consultative discussions, research, and workshops organised by SchoolNet Africa's Campaign for One Million PCs;
- the TCO model developed by SchoolNet Namibia; and
- the TCO model and work done to date by the Global e-Schools and Communities Initiative (GESCI), and more recently by the NEPAD e-Schools project.

That said, utilization of TCO models in the planning and assessment of ICT and education initiatives in Africa remains quite low.

ICT ACTIVITIES AND INITIATIVES IN NON-FORMAL EDUCATION IN AFRICA

GENERAL OBSERVATIONS

The use of ICTs in non-formal education is relatively disparate across Africa. Many of programmes focus on developing ICT literacy among targeted communities: the unemployed; underprivileged youth; women; rural communities; and, in some cases, civil society organisations. Some are distance learning programmes, and many offer face-to-face training courses, some of which are accredited, while others provide certificates of attendance.

- *Radio*
  In some countries, radio is used to disseminate education programmes to poor communities. Sierra Leone is one example of this.
- *Internet*
  Guinea is an example of a country conducting adult literacy programmes via the Internet.
- *Open schools consortium*
  A number of countries in southern Africa have established an open schools consortium that involves a range of institutions providing secondary education through distance learning. Their focus is on preparing learners to secure sustainable livelihoods by improving their academic qualifications and providing training to create and maintain income-generating opportunities. These institutions will be sharing their resources and experience in developing academic and vocational education programmes and materials.
- *Mobile Internet vehicles*
  Mauritius has introduced a Cyber Caravan Project that is aimed at making ICT facilities available in the most isolated areas in Mauritius. The Mauritian National Computer Board operates two cyber caravans, which are equipped with nine and 10 PCs respectively and Internet connection. Training is provided on board based on the needs of the communities and includes ICT literacy and awareness courses, including one specifically targeted at children. The cyber caravan is also used to offer free skills training for unemployed people in an attempt to increase their prospects for employment. Zimbabwe has also used mobile Internet buses ("Big Blue").
- *Computer kiosks*
  An initiative that can be considered the South African equivalent of the "hole in the wall" project piloted in India, known as the Digital Doorway, introduces computer literacy to rural and disadvantaged communities by making computer equipment and open source software available in the form of computer kiosks to enable people to experiment and learn without formal training and with minimal external input. These kiosks will be rolled out to 122 sites across the country.
- *ICT literacy*
  A number of civil society network organisations run digital literacy or ICT awareness programmes for targeted groups, organisations, and individuals. SangoNet and WomensNet in South Africa, WougNet in

Uganda, Kubatana.Net in Zimbabwe, the Community Education Computer Society (CECS) in South Africa, and AngoNet in Angola are a few examples operating predominantly in the southern African region. Kenya has the Mkuru Promotion Centre, which develops ICT skills, particularly for underprivileged youth.

- *Community learning centres*
  UNESCO has assisted with the establishment of community learning centres in five African countries. The project provided the centres with digital radios, data interfacing equipment, and technical backup, and the centres were set up to enable large numbers of local learners to participate in a course on telecentres. The course was delivered using the Combined Live Audio and Slide Show (CLASS) technology of WorldSpace Corporation.
- *Videoconferencing*
  Egypt has a video-conference distance learning centre that links 27 sites across the country to provide learning facilities in remote areas.

GENDER EQUITY AND ICT IN EDUCATION

GENERAL OBSERVATIONS

A significant body of work demonstrates that ICTs are not gender neutral and that gendered power relations are inherent in the production, distribution, and consumption of ICTs, even within education systems because they take place through institutions with socially embedded gender relations.[16, 17, 18] This perspective is reflected to some extent in the ICT environment in Africa. It has been argued that the digital divide in Africa is also a gender divide, as evidenced through extensive differential access, use, and production of digital technologies between girls and women in comparison with boys and men. A study commissioned by World Links for Development found that, in reality, it is harder for girls to access computer laboratories, particularly in Uganda and Ghana, especially after school hours.[19] These findings have been corroborated by other notable studies [20,.21]

POLICY ENVIRONMENT

- A study conducted by the United Nations Division for the Advancement of Women in 2002–2003 revealed Guinea to be the only country in Africa with an ICT policy that comprehensively covers gender equity concerns.[22]
- A few examples with specified references to gender equity and the empowerment of women are:
  - Mozambique's ICT policy adopted in 2000;
  - South Africa's telecommunications policy;
  - both Ghana's National and sectoral education policies; and
  - Benin's, Zambia's, Kenya's, Tanzania's, and Uganda's national ICT policies.

- In cases where reference to gender equity has been made, they range from dedicated chapters on gender equity that promote women in decision-making, e-commerce, content development, training, and applications (Mozambique), to references to women in the context of human capital development with a women's desk as a prerequisite for every ministry (Tanzania), to addressing "gender mainstreaming" and gender balance (Uganda).[23]
- In some cases, implementation strategies are inconsistent with policies related to gender equity. For instance, while Mozambique's ICT policy reflects a gender equity perspective, its ICT implementation strategy is silent on these issues with women mentioned only with reference to being victims of pornography, abuse, and violence on the Internet.[24]
- In other instances, countries with no explicit reference to gender equity in their national ICT policies have programmes targeted specifically at women. Mauritius is one example; it has a dedicated ICT literacy programme targeted specifically at women who are certified for attendance at the end of their training, but no explicit mention is made of gender equity or women's empowerment in its ICT policy.
- A few countries like Benin, Botswana, Burkina Faso, Comoros, Madagascar, and Malawi make no explicit references to gender in their national ICT policies.

GENDER MAINSTREAMING AND TARGETED APPROACHES

Conscious interventions to promote gender equity and women and girls' empowerment have focused on awareness-raising, capacity-building among women and girls, and the development of gender-responsive policy.

Some projects across Africa have adopted gender mainstreaming strategies that make the differential concerns of women and men an integral part of the design, implementation, monitoring, and evaluation of policies and programmes in all spheres. SchoolNet Africa has demonstrated consistent integration in practice of a gender equity and women's empowerment perspective within its universal access teacher and learner-based programmes. In addition to attempts to engender the ICT for education agenda through the adoption of a gender mainstreaming approach, SchoolNet Africa also promoted preferential treatment of women and girls and the development of a cadre of women leaders as part of a strategy for awareness raising and challenging unequal gender power relations. One dedicated project, SchoolNets in Africa: The Female Face, documents stories of leading women digital pioneers in African education in an attempt to demonstrate how ICTs have contributed to the empowerment of women and shifts in perceptions on the capability of women.

Organisations like the Association for Progressive Communications (APC) have a Women's Networking Support Programme (WNSP) with active members in Africa such as WomensNet in South Africa and the Women of Uganda Network (WOUGNET). These have been instrumental in lobbying for gender inclusion in ICT policy at national and international levels including at the World Summit on the Information Society along with and as part of the WSIS Gender Caucus. APC has also developed a gender evaluation methodology to support gender evaluations.

Some projects have developed targeted approaches to the development of girls and women, as three examples show:

- In Angola, a UNICEF-supported EMIS project aims to track girls' participation in schools.
- SchoolNet Namibia leads the way in promoting home access to computers for Namibia's teachers, 75% of whom are women. It also established a dedicated comic magazine with positive female heroes and role models promoting women's empowerment and gender equality in the use of ICTs.
- SchoolNet Uganda has trained women teachers in PC refurbishment.

Fair use policies involve guidelines established and accepted by school management that encourage gender equitable access and use of ICTs in schools.[25] The case has been made for the adoption of fair use policies in schools that promote equitable access to PC labs.[26] A number of African schools have adopted use policies for their computer labs, but the adoption of gender-responsive fair-use policies exist mainly in theory at this stage. The African SchoolNet Toolkit produced by SchoolNet Africa and the Commonwealth of Learning takes an important step in promoting this approach.[27]

FACTORS ENABLING AND CONSTRAINING ICT USE IN EDUCATION IN AFRICA

The factors enabling and constraining ICT applications are essentially the same in both developed and developing economies, although they obviously differ in terms of importance, depending on which side of the digital divide they are viewed from. What differentiates the rate of adoption and diffusion of ICT in education is not the factors at play, but rather the degree to which they have been developed or are present in a given country.

Table 4 provides a general picture based on the country reports.

TABLE 4: Enabling and Constraining Features Affecting ICT Implementation

Factors	Enabling Features	Constraining Features
Policy framework and implementation plans	Most countries have developed, or are in the process of developing, a road map for the incorporation of ICT in their education systems. Some have detailed implementation plans with priorities and timetables and measurable indicators in place.	The predominant focus is more on the development of ICT operational skills than on the integration of ICT in pedagogical practice.
Advocacy leadership	Progress in the development of policies and implementation plans has typically had champions for ICT in education from various sources: the office of the president, line ministers and senior staff, and from civil society such as women's and country-based schoolnet organisations.	Advocacy needs to be both visionary and practical in the sense of not raising expectations beyond what is possible in the near term.
Gender equity	A few policies promote gender equity in terms access to ICT and the development of ICT competencies.	A larger number of policies do not consider gender equity issues at all and many implementation strategies have not considered the promotion of gender equity.
Infrastructure and access	Cyber cafés in urban areas provide public access for those who can afford to pay. Access for secondary and tertiary education institutions is growing rapidly in urban areas through wireless networks. Growth in mobile phone technology is also growing rapidly.	The major constraints are inconsistent or unavailable supply of electricity, lack of ICT equipment, overcrowding of computer labs, and lack of affordable access to connectivity with acceptable bandwidth.
Collaborating mechanisms	Collaboration models are emerging at national levels to involve stakeholders in policy development and implementation, to encourage investment in ICT development, and to share access to, and cost of, network accessing.	The notion of international collaboration on matters of content development, training, support services, etc. is not yet being explored aggressively.

(*Continued on next page*)

TABLE 4: Enabling and Constraining Features Affecting ICT Implementation

Factors	Enabling Features	Constraining Features
Human resource capacity	The need to train teachers in the use of ICT, to develop ICT user skills among education administrators, and a capacity to provide local support for ICT users is recognised in the policies and plans.	The shortage of skills limits the implementation process.
Fiscal resources	Governments are starting to recognise the need for investment and many now have ICT-related line items in their annual budgets.	The lack of resources is a serious limitation in all countries. There is a general dependence on donors for the implementation of policy.
Learning content	Initiatives to develop on-line content repositories of freely available learning materials are becoming commonplace in the global world of education. These are likely to be adopted on a regional basis in Africa.	The lack of local digital content is a general problem. There is currently substantial reliance on content from the private sector. There is a need to develop materials in indigenous languages. The predominant use of English on the Internet is also constraining.
Procurement regulations		While a few countries have modified their policies to eliminate or reduce import duties on ICT equipment and software, this has yet to be adopted as widespread practice.
Attitudes	Unlike many parts of the developed world, staff and teachers appear to be more welcoming of the prospect of ICT in education.	Governments can encounter inter-ministerial jurisdiction issues regarding the control and management of ICT applications.
Sustainability	There are many examples of schools with ICT equipment and connectivity to the Internet developing services for the wider community on a cost-plus basis in order to generate revenue.	Meeting the ongoing costs of maintaining equipment, staff training, connectivity, content materials acquisition, and development and consumables is a major challenge. Some governments are allowing an ICT surcharge to be levied on students, but that is discriminatory. Planners need to improve their analysis of the true cost of ownership of the ICT models they adopt.

ICT IN EDUCATION IN AFRICA: A WAY FORWARD

This survey has demonstrated that the progress being made in the adoption and diffusion of ICT in education throughout Africa, particularly in these early years of the 21st century, is remarkable. However, in terms of broad impact on learners, the process is just beginning. What follows are some suggestions and comments regarding actions in key areas of ICT in education that will be important to attend to as the adoption process continues. As well, suggestions for a strategy to maintain and enhance the currency of the data that has been gathered are included.

MOVING FORWARD ON IMPLEMENTATION OF ICT IN EDUCATION

- *Monitoring implementation*
  There are many excellent models of comprehensive ICT in education policies that can be pointed to as examples of good practice in an African context. It would be useful to monitor the implementation of policies in selected countries in order to investigate the processes used to determine if there are lessons to be learned.
- *ICT as the 'silver bullet'*
  There are a few countries that continue to have a rather singular emphasis on the development of ICT infrastructure as the "silver bullet" for achieving socio-economic development. However, as noted in a recent study cited in the *Electronic Journal on Information Systems in Developing Countries,* investment in ICT by itself does not foster human development, but must be accompanied by investment in education and health as well.[28]
- *Total Cost of Ownership*
  The efforts of organisations such as Global e-Schools and Community Initiatives, schoolnets, and NEPAD e-Schools to develop "total cost of ownership" models for ICT in education are exemplary and should be supported. They need to be backed by good financing models that encourage budgetary commitment on the part of governments and incorporates multi-partnership, multi-stakeholder approaches.
- *ICT in Education vs. Education in ICT*
  While the practice of equipping schools with computers and using them to teach computer literacy and use packaged content to augment teaching is useful, the goal of fully integrating ICT in educational administrative and pedagogical processes will continue to be constrained by the lack of access to ICT infrastructure, affordable connectivity with sufficient bandwidth, and a reliable supply of electricity.
- *Teacher professional development*
  Teacher training needs to involve much more than the development of computer literacy skills. Teachers need to be able to design and adapt content materials to suit student needs, to search and manage information, and to be aware of the ethics and dangers inherent in the use of ICT technologies. These are some of the ways in which ICTs need to be integrated into continuing teacher professional development and training programmes. The NEPAD e-Schools project in its Framework for Teacher

Professional Development and Training, the African Virtual University's (AVU) Teacher Education Project, and UNESCO's Teacher Training in Sub-Saharan Africa (TTISSA) programme serve as good examples of continuous, integrated approaches to teacher development in the use of ICTs.

- *Pan-African collaboration*
  The opportunities for regional, and perhaps continental, collaboration in the development of digital learning materials are huge in terms of the quality of the content, their relevance to the lives of learners, and the cost savings that would result from shared development. Cross-border collaborative content development models are emerging rapidly in other parts of the world and are beginning to emerge in Africa. The open education resources movement is growing apace in Africa supported by groups like the Hewlett Foundation. Organisations such as Learnthings Africa and Mindset Network have engaged in capacity-building programmes to promote local digital content development.
- *Leadership*
  The importance of strong leadership in effectively implementing ICT in education is evident from many of the country reports. Building African leadership capacity in this sector will be instrumental in the continuing success of education development on the continent.

CONTINUING TO BUILD AN INFORMATION BASE FOR ICT IN EDUCATION IN AFRICA

This survey was intended to gather information about the adoption and diffusion of ICT in education in Africa in a few key areas. While the results need to be interpreted in the context of the limitations described in the 'project background' section of this report, the survey marks the first time that such data have been gathered and presented in one place. In order for the currency of the data to be maintained, and the database to continue to grow, the following suggestions are offered:

- *Keeping information current*
  Developments in ICT applications in education in Africa are happening on a daily basis, with the result that the data of the sort collected in this Survey will become dated very quickly. While on-line tools (such as WikiEducator) could be used to keep the data current, the experience from this survey process indicates that it would require an animation strategy that was supported by all stakeholders in order to be successful. There is an opportunity for *info*Dev and its partners to take exemplary leadership to demonstrate how these collaborative on-line tools can be used to develop information databases and keep the data current.
- *Evaluation*
  The literature pertaining to ICT in education is mostly descriptive of projects and initiatives, and while this is very useful, there is a paucity of data from well-designed evaluation and research studies—particularly in Africa. The developments chronicled in this report provide a myriad of venues for the conduct of such studies across the continent which would provide information that would be of immense value to both practitioners and decision-makers.
- *Resource bibliography*
  A bibliography was developed to assist the regional researchers in the preparation of their country reports, and consideration should be given to identify how this resource might be used a broadly as possible. One option would be to incorporate it into an existing bibliographic project focused in ICT in education such as that currently being led by the South African Association for Distance Education (SAIDE).

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ANNEXES

ANNEX 1:
REGIONAL ICT IN EDUCATION INITIATIVES IN AFRICA

A wide range of programmes and projects on ICTs in Education in Africa have activities that involve one or more African countries in varying numbers. These range from high-level intergovernmental, multi-stakeholder programmes such as the NEPAD e-Schools initiative, to institutions focused on networking African schools and universities such as the African Virtual University (AVU), to collaborative learning projects that directly involve learners and teachers from schools in several African countries such as the Global Teenager Project (GTP) and the International Education Resources Network (iEARN).

An illustrative (non-exhaustive) list of prominent organisations active in supporting and promoting technology-related activities in the education sector in Africa is provided below. Individual country activities are described in respective country reports available in this Survey.

African Academy of Languages | *www.alacan.org*
The African Academy of Languages is a pan-African organisation that was set up in 2001 by Mali's then president Alpha Konare. It was established under the auspices of the African Union to promote Africa's many indigenous languages. One of its major projects relates to the promotion of African languages in "cyberspace" and particularly the use of local languages in education in Africa.

African Development Bank | *www.afdb.org*
The African Development Bank (AfDB) is a membership-based, regional multilateral development finance institution that mobilises resources to support the economic and social development of its member countries. The AfDB has an education policy which promotes support for basic, vocational, and adult education and training. The AfDB also supports the use of ICTs in education in Africa. To date the AfDB has assisted with open, distance, and e-learning capacity development centres and connectivity provision at Africa Virtual University (AVU) partner institutions to support teacher training and development programmes and to mainstream gender issues, as in the AVU Support Project.

African Virtual University (AVU) | *http://web.archive.org/web/20060426202907/www.avu.org*
Initially a project of the World Bank and now an independent intergovernmental organisation, the AVU is an innovative education institution based in Nairobi, Kenya, that services 57 learning centres in 27 African countries. The AVU works with universities based in Africa and other countries such as the US and Australia to provide academic programmes and short courses through open and distance e-learning. The AVU also boasts a digital library that provides resources to African academics and students.

AMD | *www.amd.com*
AMD is a leading global provider of innovative processing solutions in the computing, graphics, and consumer electronics markets. AMD introduced the 50x15 Initiative which is an attempt to promote affordable, accessible Internet connectivity and computing capabilities for 50% of the world's population by 2015. AMD has introduced its personal Internet communicator (PIC) device which it deployed to African schools through its support for the NEPAD e-Schools programme. In Africa, AMD led a consortium of companies in the promotion of the NEPAD e-Schools Demonstration Project in five African countries (Cameroon, Gabon, Mali, Senegal, and Uganda) where they promoted their 50x15 devices.

Association for the Development of Education in Africa (ADEA) | *www.adeanet.org*
ADEA is a network of partners promoting the development of effective education policies based on African leadership and ownership. ADEA has produced research and guidebooks on the use of ICTs in education such as *Towards and Information System for Non Formal Education: A Practical Guide*.

Computer Aid International | *www.computeraid.org*
Headquartered in the UK with a dedicated African regional programme comprising officers in Southern, Eastern, Central, and West Africa, Computer Aid International specialises in sourcing and distributing professionally refurbished computers for re-use in education, health, and not-for-profit organisations in Africa and other developing countries. To date Computer Aid International has distributed more than 80,000 PCs to developing countries.

Computers for African Schools (CFAS) | *www.cfas.org.uk*
CFAS is a registered charity in the UK that mobilises computer donations from firms and computer users and distributes them to schools in Southern Africa through partner organisations based in Malawi, Tanzania, Zambia, and Zimbabwe.

Cisco Systems | *www.cisco.com*
Cisco Systems is a global company that promotes networking for the Internet. In Africa, Cisco is a leading partner in the New Partnership for Africa's Development (NEPAD) e-Schools programme to which it contributed human and financial resources. Cisco led a consortium of companies in this project in which it promoted the installation of networking equipment for Internet access and satellite connectivity in schools in Algeria, Ghana, Mauritius, Rwanda, Senegal, and South Africa. It also promoted the use of digital education content and teacher training in these countries. In addition, Cisco has established a *Networking Academy programme that* trains students to design, build, and maintain computer networks. A number of Networking Academies have been established in Africa in countries like, Ghana, Mauritius, and Nigeria.

Commonwealth of Learning (COL) | *www.col.org*
The Commonwealth of Learning (COL) is an intergovernmental organisation created by Commonwealth heads of government to encourage the development and sharing of open learning/distance education knowledge, resources, and technologies. COL has historically assisted with the development and support of national ICT for education policies in some African countries that form part of the Commonwealth, and have promoted the growth of national schoolnet organisations through networking workshops, action research, and the publication of guidebooks such as the *African SchoolNet Toolkit* which it produced in partnership with SchoolNet Africa. COL is also spearheading the establishment of a Virtual University for Small States of the Commonwealth (VUSSC) which involves a number of small states in Africa and which serves as a network committed to the collaborative development of free content resources for education. COL is also involved in a programme on ICTs in support of technical vocational education and training in Africa in partnership with UNESCO.

Department for International Development (DFID) | *www.dfid.gov.uk*
DFID is the official ministry within the British government that promotes the fight against world poverty. DFID supports numerous bilateral programmes in Africa in support of education, the Education For All objectives, and the Millennium Development Goals. With particular reference to ICTs in education in Africa, DFID has in the past established organisations such as Imfundo, which has developed a knowledge bank of research on the experiences related to ICTs in education in Africa; DFID has also supported research done by the TESSA programme.

Digital Links | *www.digital-links.org*
Digital Links is headquartered in the UK with offices in South Africa and Tanzania. They provide an IT disposal service to UK companies, and refurbish computers for re-use in schools, NGOs, and small enter-

prises in Africa and the developing world. To date, Digital Links has distributed more than 50,000 PCs to developing countries

Edubuntu | *www.edubuntu.org*
Edubuntu involves a group of people who distribute a complete Linux-based operating system to schools for classroom use, with future versions being made available for university use. Edubuntu also provides community-based support. Edubuntu philosophy promotes free and open source software and espouses that software should be freely available, that software tools should be usable by people in their local language, that software should be used anyone including people with disabilities, and that people should have the freedom to customise and change their software in whatever way they see fit.

eGranary Digital Library | *http://www.widernet.org/digitallibrary/*
Supported by partnership between the Hewlett Foundation, USAID, and the McArthur Foundation, among others, the eGranary Digital Library provides millions of digital educational resources to institutions that do not have adequate Internet access. They deliver digital education resources by gaining permissions, copying Web sites, and delivering them to intranet Web servers in their partner organisations in Africa and other developing countries. They recently initiated satellite data broadcasting to deliver digital resources to African education institutions.

eLearning Africa | *www.elearning-africa.com*
eLearning Africa is an international conference on e-learning which is hosted annually by the government of an African country. The main focus of these conferences is on the experiences of ICTs in education in Africa relative to the rest of the world. The conference is organised by ICWE and Hoffmann & Reif Consultants. In 2006 the conference was held in Addis Ababa, Ethiopia; in 2007 it was held in Nairobi, Kenya; and in 2008 it will be held in Accra, Ghana.

Free and Open Source Software Foundation for Africa (FOSSFA) | *www.fossfa.net*
FOSSFA was launched in February 2003 as a network of practitioners, professionals, and organisations promoting the use of free and open source software for Africa's development. FOSSFA has an education subdivision focused on the promotion of open source solutions in education in Africa

Geekcorps | *www.geekcorps.org*
IESC Geekcorps is an international non-profit organisation based in the US that promotes digital skills transfer and independence through various programmes that involve volunteers with technical expertise. Geekcorps has supported a few programmes in Africa such its Last Mile Initiative in Mali, which promotes telecommunication-based business models for people without ICT access in rural areas, and the Digital Freedom Initiative in South Africa, which promotes the benefits of ICTs to small businesses.

Global Development Learning Network (GDLN) | *www.gdln.org*
The Global Development Learning Network (GDLN) is a global partnership of approximately 120 learning centres that provide tools and services in support of distance learning through ICTs. Learning centres based in a number of African countries, including Benin, Ethiopia, Ghana, Senegal, Tanzania, and Uganda, form part of the GDLN network.

Global e-Schools and Communities Initiative (GeSCI) | *www.gesci.org*
Promoted by Ireland, Switzerland, Sweden, and Canada, GeSCI was established in 2003 by the United Nations ICT Task Force in an attempt to raise global standards of education for communities in the developing world and to help make the UN Millennium Development Goals a reality. In Africa, GeSCI has focused its work in Namibia and Ghana by supporting policy development and implementation. It has expanded its work to Kenya and Rwanda as well. GeSCI has also developed knowledge products such as a toolkit on total cost of ownership.

Global Teenager Project (GTP) | *www.globalteenager.org*
The Global Teenager Project is an initiative of the Dutch-based International Institute for Communication and Development (IICD). It was launched in 1999 to promote the use of ICTs in the classroom. The project focuses on collaborative learning among secondary school students and teachers from around the world through a safe, structured virtual environment known as "learning circles." Thus far the project involves about 3,000 teachers and students from 200 classes in over 29 countries. The most participants are from Africa, involving learners, teachers, and schools from 12 countries.

Hewlett Foundation | *www.hewlett.org*
Based in San Francisco, the Hewlett Foundation provides resources in support of activities in education, environment, global development, performing arts, and population. In Africa, the Hewlett Foundation has promoted the development of open education resources, and it supported the AVU in the development of a comprehensive open educational resources architecture to ensure the efficient application of the open content movement in African higher education and training institutions. It also supported the Meraka Institute in South Africa to promote the development of a collection of papers describing the use of open educational resources in tertiary education, in primary and secondary schools, and within communities in South Africa.

Highway Africa | *www.highwayafrica.ru.ac.za*
Highway Africa is an annual ICT conference hosted by Rhodes University in South Africa. Each year, more than 500 delegates from across the globe attend the conference to discuss issues relating to Internet governance, ICT policy, and media for democracy. Highway Africa also produces a weekly on-line bulletin, the *HANA Weekly Digest*, which documents progress in ICT for development, including ICTs in education in Africa.

International Development Research Centre (IDRC) Acacia |*www.idrc.ca*
The IDRC is based in Canada and its Acacia programme, which was established in 1996, seeks to empower sub-Saharan communities with the ability to apply ICTs to their own social and economic development. The IDRC has supported a number of pilot projects and action research in the area of ICTs in education, particularly the initial establishment of schoolnet organisations in some African countries.

International Education Resources Network (iEARN) | *www.iearn.org*
iEARN is one of the largest and oldest global networks of teachers and learners that use ICTs in a diverse range of collaborative learning projects. All iEARN projects are designed, initiated, and run by teachers and learners. Its network in Africa involves learners and teachers from schools in 29 countries.

International Institute for Communication and Development (IICD) | *www.iicd.org*
The IICD is a non-profit foundation based in the Netherlands that specialises in ICTs for development. The IICD has supported a number of programmes such as its Global Teenager Project as well as projects supporting teacher development through ICTs in Tanzania and ICT for education policy processes in Zambia.

Intel | *www.intel.com*
Intel is a global company focused on silicon innovation and development of technologies, products, and initiatives, to continually advance how people work and live. Intel's education efforts centre on improving teaching and learning through the use of ICTs. The focus is on advancing math, science, and engineering education and research. Intel also works with education leaders worldwide on solutions that support the creation of 21st century skills. Their programme, Intel Teach, which is currently running in Ghana, Egypt, Nigeria, and South Africa, has reached four million teachers in 40 countries and is targeted to reach 10 million by 2011. Intel recently announced its new Intel World Ahead programme, a project to provide cheaper computers to schools and boost wireless Internet links. Target countries in Africa are Egypt, Ghana, Kenya, Nigeria, and South Africa.

LinuxChix Africa | *www.africalinuxchix.org*
LinuxChix Africa was formed in 2004 by a group of African women to promote the development of free and open source software, particularly Linux skills.

Microsoft | *http://www.microsoft.com/education/*
Working closely with worldwide education communities, Microsoft has developed technology, tools, programmes, and solutions to help address education challenges while improving teaching and learning opportunities. In countries like Ghana, Kenya, and South Africa, Microsoft has promoted low-cost access to software for schools. In addition, Microsoft established its Partners in Learning programme and its related Innovative Teachers Network which supports teacher development projects in a number of African countries.

Mtandao Afrika | *www.mtandao-afrika.org*
Formerly known as ThinkQuest Africa, Mtandao Afrika holds a n Internet challenge contest for African youth. The contest focuses on the collaborative development of educational Web sites by youth who work in multinational teams and who are awarded prizes by a panel of international judges.

NEPAD e-Schools | *www.eafricacommission.org*
This initiative aims to impart ICT skills to young Africans in primary and secondary schools as well as harness ICT technology to improve, enrich, and expand education in African countries. The aim is to equip all African primary and secondary schools with ICT apparatus such as computers, radio and television sets, phones and fax machines, communication equipment, scanners, digital cameras, and copiers, and to connect them to the Internet. Each school will be equipped with a "health point." which encourages the use of the schools' ICT resources by the broader community. NEPAD e-Schools is currently concluding its first Demo project which involved 16 African country governments collaborating with five consortia companies in the provision of ICT resources to six schools in each of the 16 countries.

One Laptop per Child (OLPC) | *www.laptop.org or www.olpc.com*
OLPC is a non-profit organisation set up to promote a low-cost laptop, known as the "$100 laptop," in an attempt to promote access to the technology to the world's children to support their learning. To date interest has been expressed by governments in Libya, Nigeria, and Rwanda.

Panafrican Research Agenda on the Pedagogical Integration of Information and Communications Technologies (ICT) | *www.observatoiretic.org/*
A knowledge network, initiated by the International Development Research Centre (IDRC), bringing together partners in eleven African countries to help researchers, practitioners, and institutions to collect and share data.

Peace Corps | *www.peacecorps.gov*
Peace Corps is an organisation based in the US that encourages US citizens to volunteer their time to work in developing countries in areas such as HIV/AIDS, information technology, and business development. In the ICT for education sector, Peace Corp volunteers have been stationed in a number of African countries to assist with the provision of technical training and support to groups and organisations that use ICTs in education.

Schoolnet Africa | *www.schoolnetafrica.net*
SchoolNet Africa is an NGO-based in Senegal that promotes education through the use of ICTs in African schools. SchoolNet Africa functions as a network of schoolnet organisations operating in 33 countries on the basis of regional programmes on ICT access, teacher training, and collaborative learning. To date SchoolNet Africa has produced a range of research reports on the experiences of African countries on the use of ICTs in schools.

Teacher Education for Sub-Saharan Africa (TESSA) | *www.tessaprogramme.org*
TESSA is a partnership led by the Open University and the African Virtual University that includes a range of African universities, the Commonwealth of Learning, and the BBC Trust. It is a research and development programme that creates open multimedia resources for sub-Saharan African teachers and teacher-educators. To date TESSA has introduced a BBC radio programme that debates the role of teachers in improving quality primary education and produced a toolkit for educators and planners on designing open and distance learning for teacher education in sub-Saharan Africa.

Teacher Training Initiative for Sub-Saharan Africa (TTISSA) | *www.unesco.org/education/TTISSA*
TTISSA is a 10-year programme co-ordinated by UNESCO aimed at improving national teacher policies and strengthening teacher education in 46 sub-Saharan African countries. It is designed to support the development of national teacher education systems in African countries to produce more and better quality teachers.

Ubuntu Alliance for Education and Research Networking | *www.ubuntunet.net*
UbuntuNet Alliance has been established to capitalise on the emergence of optical fibre and other terrestrial infrastructure opportunities and thus become the Research and Education Network (REN) backbone of Africa. Tertiary education and research institutions throughout the rest of the world are connected to the Internet using fast, low-cost fibre.

United Nations Economic Commission for Africa (UNECA) | *www.uneca.org*
The Economic Commission for Africa (ECA) was established by the United Nations to promote the economic and social development of its member states, foster intra-regional integration, and promote international co-operation for Africa's development. UNECA has historically led the African Information Society Initiative (AISI) since 1996 and has been instrumental in supporting the development of national information and communication infrastructure (NICI) policies and plans in a number of African countries. Since 1999 UNECA has also adopted the formation of an African Learning Network which incorporated the formation of SchoolNet Africa, Out of School Youth Network, and Varsity Network.

United Nations Educational, Scientific and Cultural Organization (UNESCO) | *www.unesco.org*
UNESCO is the UN's specialised agency for education. UNESCO has had a range of programmes and projects to support the use of ICTs for development, specifically in education. UNESCO promoted the establishment of telecentres and community learning centres in a number of African countries. More recently UNESCO has promoted the development of a regional programme on technical and vocational educational education and training through the use of ICTs in Africa, in partnership with the Commonwealth of Learning. UNESCO also leads the TTISSA programme.

United States Agency for International Development (USAID) | *www.usaid.org*
USAID was among the first donor agencies to support ICTs in education. Through its Leland Initiative in 1996, USAID provided grant aid for pilot projects in a number of African countries. USAID later supported the establishment of the Dot Com Alliance for e-learning and e-governance programmes in Africa such as the Network for Capacity Building and Knowledge Exchange project.

The World Bank | *www.worldbank.org*
Headquartered in Washington, DC, the World Bank is an international development institution that provides low-interest loans, interest-free credit, and grants to developing countries for education, health, infrastructure, communications, and many other purposes. The World Bank has historically supported a variety of programmes and projects for education through ICTs. These include the African Virtual University, World Links for Development, and the Global Development Learning Network.

World Computer Exchange | *www.worldcomputerexchange.org*

Headquartered in the US, the WCE sources secondhand computers and support services to partner organisations in developing countries. To date the WCE has established 289 partners in Africa from 25 countries and has sent 42 shipments of computers to these countries.

World Links | *www.world-links.org*
World Links is an independent organisation headquartered in Washington, DC spun off from the World Bank to promote ICTs in education in schools in developing countries across the world. In Africa, World Links has historically been a pioneering organisation in the promotion of ICT access and teacher development in eight African countries through various programmes and partnerships.

ANNEX 2:
A SELECTED BIBLIOGRAPHY OF ICT IN EDUCATION IN AFRICA

***Please note*:** This bibliography was developed during the initial phase of a survey initiated by the Information for Development Program (*info*Dev) , carried out in partnership with the Commonwealth of Learning (COL). The primary purpose of the bibliography was to assist researchers compiling country reports on the state of ICT use in education in Africa in early 2007, it is being shared here in case it might be useful to others and, more importantly, that others will add items and offer suggestions for improvement.

The items in this collection have been selected on the basis that they provide data about ICT in education policy development and implementation processes; current projects; constraints in implementing ICT-enabled education; available infrastructure, teacher professional development and training; and digital education content development. The bibliography is therefore a potpourri of studies, evaluation reports, government policy documents, news items, and reports from other surveys that have been written since 2000.

Additional resources are listed at the end of each of the 53 country reports.

This bibliography should be regarded as a work in progress. It has been posted on the WikiEducator site (*http://www.wikieducator.org/ICT4EdAfrica*) established to support the survey process; we welcome your input in suggesting additional resources.

Sections:

1. General ICT in Education References
2. ICT Infrastructure
3. Primary and Secondary Education
4. Tertiary Education
5. Non-formal Education
6. Distance Education and Open Learning
7. Gender and ICT

1. GENERAL ICT IN EDUCATION REFERENCES

"African Virtual Open Initiatives and Resources (AVIOR)." *http://avoir.uwc.ac.za/avoir/index.php?module=cms*.
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"Africa's e-Learning Program in ICT Policy and Regulation." 2005. *DOT COMments e-newsletter.* Issue 14. *http://www.dot-com-alliance.org/newsletter/print_article.php?article_id=138*.
The Network for Capacity Building and Knowledge Exchange (NetTel@Africa) has created a unique on-line learning programme that is changing the way policymakers think about ICT policy reform.

Beebe, M.A. et al. (eds.) 2003. *Africa Dotedu: IT Opportunities and Higher ED in Africa.* New Delhi, India: Tata McGraw-Hill Publishing Co. *http://www.africadotedu.org/*.

This book chronicles and analyses the growth of the Internet in Africa, provides descriptions of regional initiatives, and highlights the role of ICT in higher education in selected countries.

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This wireless high-speed data network, called Ten by Ten, is currently supporting a range of users across Uganda, including donor-funded teaching colleges, government organisations and commercial enterprises.

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The book provides a comprehensive analysis of ICT policy development in Kenya, Rwanda, Uganda, and Tanzania.

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An assessment of UNESCO's CMC initiative that promotes sustainable local development through community-based facilities combining traditional media like radio, television, and print with ICTs such as computers, the Internet, and mobile devices.

"Gaible, Edmond and Mary Burns. "Using Technology to Train Teachers: Appropriate Uses of ICT for Teacher Professional Development in Developing Countries." 2005. *info*Dev / World Bank.

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"Knowledge Aid for Sierra Leone." 2004. *http://www.knowledgeaid.org/action.htm*.
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Building on the success of the previous Interactive Radio Instruction for Somalis, SIRIP has a series of interactive radio instruction programmes for students in Grades 1 to 6.
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South Africa Draft ICT in Education Implementation Plan. 2006. National Department of Education.
The document provides information on the status of access to and use of ICTs in South African schools and a proposed strategy to improve access, use and integration in learning and teaching.
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"State of the Art telecentre in Tunisia." 2006. telecentre.org. *www.telecentre.org/en-tc/node/15674*.
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"Timebound Program on Eliminating Child Labor in Tanzania.". 2002–2006. International Education Systems (IES). *http://ies.edc.org/ourwork/project.php?id=3224&topic=13*.
A report of an interactive radio instruction series called Mambo Elimu that reached approximately 10,000 children in Tanzania who had no access to formal education. A similar project has been conducted in Somalia.
World Links. 2006. "Global Report 2006. *www.world-links.org/images/stories/Documents/global%20report.pdf*. World Bank, Washington, USA.
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4. TERTIARY EDUCATION

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This issue has articles on the Cameroon interuniversity network, Kenya's education network that provides interconnectivity to all institutions of higher learning, the UbuntuNet Alliance for bandwidth consistency in higher learning institutions, the ICT situation at the Universite Cheikh Anta Diop de Dakar, Senegal, and the Forum, a national network in Nigerian Higher Education Institutions.

"African Virtual University ". 2005. Nairobi, Kenya: African Virtual University. *http://www.avu.org/about.asp*.
The objective of the AVU is to build capacity and support economic development by leveraging the power of modern telecommunications technology to provide world-class quality education and training programmes to students and professionals in Africa. The open, distance, and -elearning initiative seeks to enhance the capacity of AVU's partner institutions to develop, deliver, and manage their own programmes.

Aguti, J. N. and William J. Fraser**. "**Integration of Information Communication Technologies (ICTs) in The Distance Education Bachelor of Education Programme, Makerere University, Uganda." July 2006. *Turkish Online Journal of Distance Education-TOJDE.* 7(3) Article 7. *http://tojde.anadolu.edu.tr/tojde23/articles/article7.htm*.
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"A Rural ICT Toolkit for Africa—African Connection. Centre for Strategic Planning." November 2006. The World Bank. *http://www.infodev.org/en/Project.11.html*.
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"AVU Capacity Enhancement Program (ACEP) Phase I." 2005. African Virtual University. *http://www.avu.org/acep.asp*.
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"The AVU Teacher Education Project." *http://www.avu.org/documents/Fact-Sheet.pdf. A description of how the African Virtual University has implemented a teacher education programme, funded by the African Development Ban), in 20 countries.*

Ayoo, P.O. "A National Distance Education (DE) Solution for Uganda." October 2003. The Inter-University Council for East Africa. *http://www.iucea.org/publications.php?publication_id=37*.
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Cisler, S. and K. Yocam. 2003. "Connect-ED Evaluation (Uganda)." EduAction. *http://www.eldis.org/static/DOC7844.htm*.
The overall task of this project was to integrate computers into the teaching methods of primary teacher college faculty and build capacity among staff by establishing computer-assisted teacher-training laboratories and resource centres. The report outlines project results, impacts, and recommendations for the future of Connect-ED.

Coupe, J. et al. "Is Constructivism Universal: In Search of Meaningful Technology in Morocco and Namibia." This paper is reprinted with the permission of UNESCO/IIEP. It will appear as chapter 8 in *Adapting Technology for School Improvement: A Global Perspective,* edited by D.W.Chapman and L. Mahlc. 2003. *http://www.eldis.org/cf/search/disp/DocDisplay.cfm?Doc=DOC7879&Resource=f1ict*.
The experience suggests that education technology programmes can enhance the quality of professional training as well as strengthen education reforms by giving ownership to the involved teachers.

"Education—Under Construction." November 2003. UNESCO. *http://portal.unesco.org/education/en/ev.php-*.
There is growing commitment by African governments to the development of ICTs and using these technologies for distance education. Additionally, there are strong indicators that open and distance learning is becoming more central to the education policy of many countries.

Edukugho, E. October 5**,** 2006. "Teachers Must Pass ICT test —TRCN.**"** Vanguard Media Ltd. *http://www.vanguardngr.com/articles/2002/features/education/edu105102006.html*.
The acquisition of basic ICT skills and capabilities is now part of the National Minimum Standards for Teacher Education and Practice in Nigeria.

"Internet in Higher Education, Research, Science, and Technology Development in Sub-Saharan Africa." 2006. Dgroups. *http://www.dgroups.org/groups/cgiar/InternetAfrica/index.cfm?op=dsp_resource_details&resource_id=33068&cat_id=17316*.
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Jallow, A.K. 2002. "Report On ICT Use In Gambia College." *http://www.widernet.org/projects/gambia/IctInGambiaCollegeReprot.htm***.**
*A needs assessment of ICT use in Gambia's tertiary institutions of learning for the WiderNet Project***.**

Jokivirta. L. 2006. "Foreign Higher Education Activity in Francophone Africa. " *World Education News and Reviews. http://www.wes.org/ewenr/06apr/feature.htm*.
A description of the most recent online foreign initiatives in francophone Africa.

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Juma, M.N. and S. D'Antoni (eds). 2006. "The Virtual University: Models and messages, Lessons from Case Studies". UNESCO (IIEP). *http://www.unesco.org/iiep/virtualuniversity/media/document/Ch10_AVU_Juma.pdf*.
The report, based on the experience of Kenyatta University, as part of the AVU, highlights the challenges faced by many African institutions as well as experiences gained in using technology to address some of them.

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"Makerere to Set Up an ICT Centre in Africa.**"** August 14, 2006. i4d. *http://i4donline.net/news/news-details.asp?catid=13&newsid=5264*.
The Makerere University Faculty of Computing and Information Technology has won an Africa Union bid to set up an ICT institution to offer ICT training for 13 countries.

Martey, A. "ICT in Distance Education in Ghana." 2004. *Library Hi Tech News Incorporating Online and CD Notes.* 21(5):16–18(3). Emerald Group Publishing Ltd. *http://www.ingentaconnect.com/content/mcb/239/2004/00000021/00000005/art00006*.
This study describes the ICT scene in Ghana from 1996 to 2004. The emphasis is on the benefits that distance learners in Ghana will derive from an ICT-enhanced distance education.

Murray, L. "AVU Gap Analysis Report: August 2005." *http://www.avu.org/acep.asp*.
This report describes the capacities of all potential partners in the consortium of universities.

"National ICT Strategy for Education and Training." 2006. Kenya Ministry of Education. *http://www.education.go.ke/ICTStrategy_Team.htm*.
The strategy outlines outcomes, implementation, management, cost analysis and monitoring, and the evaluation processes.

Ng'ethe, N. et al. 2003. "Higher Education Innovations in Sub-Saharan Africa: With Specific Reference to Universities." ADEA Working Group on Higher Education for the Partnership on Education. *http://*

www.aau.org/wghe/publications/wghe_innovations_ref_univ.pdf.
The survey sought to identify and document higher education innovations currently underway in Sub-Saharan Africa.

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The loan will be used to deploy the National Technology Development Agency's mobile internet units to rural areas as part of the effort to stimulate interest in ICT in the country.

Ouma, A.P. "A National Distance Education (DE) Solution for Uganda: Innovative Application of Digital ICTs to Overcome the Barriers of the Existing Digital Divide." October 29, 2003. Paper presented at the IITE Specialized Training on ICTs for Distance e-Learning for Countries in sub-Saharan Africa conference at the University of South Africa. *http://www.iucea.org/publications/DE_Solution_%20Uganda.doc*.
A comprehensive analysis of the Ugandan higher education system in terms of the opportunities for ICT applications and the constraints that need to be addressed.

Perraton, H. October 2001. "Teacher Education Through Distance Learning." UNESCO. *http://portal.unesco.org/education/en/ev.php-URL_ID=45578&URL_DO=DO_TOPIC&URL_SECTION=201.html*.
A summary of case studies in Burkino Faso, Nigeria, and South Africa to ascertain what methods were being used and how effective they were.

Sagna, O. and S. D'Antoni (eds). "The Virtual University Models and Messages." 2006. UNESCO (IIEP). *http://www.unesco.org/iiep/virtualuniversity/media/document/Ch5_CNFD_Sagna.pdf*.
The Campus numérique francophone de Dakar, Senegal, inaugurated in 2000, functions essentially as a well-equipped resource centre, promoting and supporting distance and ICT-enabled education through the production of multimedia content, the promotion of distance education courses and CD-Roms, an incubator for innovative firms, the development of digital literacy in students and teachers, and access to on-line information.

"Somalia: Online Distance Learning Initiative Fact Sheet.". August 2006. UNDP and World Bank. *http://www.reliefweb.int/library/documents/2006/undp-som-26aug.pdf*.
The ODL Learning Initiative is using VSAT to access Internet connectivity for knowledge resources and interactive learning in selected Somali universities/tertiary institutions.

Steiner, R. et al. "The African Tertiary Institutions Connectivity Survey Report." 2004. *http://www.dgroups.org/groups/cgiar/InternetAfrica/docs/ATICS2004Report.pdf*.
The report is based on a survey of 83 institutions in 40 countries to discover their needs and willingness to participate in a "bandwidth purchasing club."

"Strategic Development Plan for Information and Communications Technology (ICT) 2003 –2005." Association for the Development of Education in Africa. *http://www.aau.org/wghe/publications/wghe_ict_strategic_plan_zimbabwe.pdf*.
This work, for the National University of Science and Technology, Bulawayo, Zimbabwe, was encouraged by the Working Group on Higher Education of the Association for the Development of Education in Africa.

"Teacher Education in Sub-Saharan Africa (TESSA)." November 2005. Open University. *http://www.open.ac.uk/education-and-languages/about_the_faculty/case_studies/teacher-education.php*.
TESSA will provide on-line training that educators can download and print or burn on CDs for use in schools across Africa.

"Towards a Strategy on Developing African Teacher Capabilities in the Use of Information and Communication Technology." October 2004. SchoolNet Africa. *http://www.schoolnetafrica.net/fileadmin/resources/Towards_a_Strategy_on_Developing_African_Teacher_Capabilit._01.pdf*.
A research summary of teacher training in ICT in Africa at pre-service and in-service levels.

Twinomugisha, A., J. Magochi and S. Aluoch. "Bandwidth Consolidation and Management for Universities." October 2000. The Partnership for Higher Education in Africa. *http://www.foundation-partnership.org/pubs/avu/index.php*.
A report prepared by the African Virtual University for the Partnership.

"UNESCO Preparing Standards for Integrating ICT into Teaching." November 1, 2006. *ICT in Education*. *http://portal.unesco.org/ci/en/ev.php-URL_ID=23023&URL_DO=DO_TOPIC&URL_SECTION=201.html*.

A UNESCO initiative designed to develop a common core syllabus defining various ICT competency skills for teachers that professional development providers can use to prepare learning materials is nearing completion.

"UNESCO to Sponsor Pilot Satellite Distance Learning Course on Telecentres in Africa." May 2004. UNESCO Daily News Service. *http://portal.unesco.org/ci/en/ev.php-URL_ID=13920&URL_DO=DO_TOPIC&URL_SECTION=201.html*.

This project demonstrated and tested the potential of digital radio to deliver low-budget, effective, multimedia-based and real-time distance education to rural learners in Ethiopia, Namibia, Tanzania, Uganda and Zambia.

"Virtual University to Become a Reality in August 2007." September 6, 2006. Commonwealth News and Information Service. Issue 301.

COL's Virtual University for Small States of the Commonwealth (VUSSC) initiative is set to become a reality in August 2007 with the launch of two of its programmes.

"VSAT Project for Pan African Countries by Indian Government." August 2005. Ghana: Ministry of Communications. *http://www.moc.gov.gh/modules.php?op=modload&name=News&file=article&sid=24&mode=thread&order=0&thold=0*.

The Minister of Communications has signed a memorandum of understanding with Telecommunications Consultants India to establish a VSAT-based tele-medicine and tele-education infrastructure for African countries.

"Work on UNESCO's ICT Competency Standards for Teachers Enters Final Phase." October 2006. UNESCO Daily News Service. *http://portal.unesco.org/ci/en/ev.php-URL_ID=23023&URL_DO=DO_TOPIC&URL_SECTION=201.html. An international standard for integrating ICTs in teaching.*

Zaparovanny,Y. "Information and Communication Technologies Usage in Higher Education in Sub-Saharan Africa.". 2004. UNESCO Institute for Information Technologies in Education (IITE). *http://www.iite-unesco.org/*.

This book contains 22 articles, nine of which are state-of-the art country studies. The largest article is the Pan African Study of "E-Campus" that gives perspectives of several higher education institutions and desk-based research on six other countries.

5. NON-FORMAL EDUCATION

"Africa Online's Infinet Will Boost Basic Education." September 8, 2006. Ministry of Communications, Republic of Ghana. *http://www.moc.gov.gh/modules.php?op=modload&name=News&file=article&sid=159&mode=thread&order=0&thold=0*.

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Akinsola, O.S., M.E. Herselman, and S.J. Jacobs. 2005. "ICT Provision to Disadvantaged Urban Communities: A study in South Africa and Nigeria." *International Journal of Education and Development using ICT.* 1 (3). *http://ijedict.dec.uwi.edu//viewarticle.php?id=57&layout=html***.**

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*"*Computerize Nigeria Project." October 2006. *This Day. http://www.independentngonline.com/news/51/ARTICLE/13160/2006-10-16.html.*

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"dot-EDU Southern Sudan Interactive Radio Instruction (SSIRI) Program." International Education Systems. *http://ies.edc.org/ourwork/project.php?id=3487&topic=13*.

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"Ethiopian Centre Promoting ICT Use by Blind People Supported by UNESCO." January 2003. *UNESCO Communication and Information Bulletin. http://www.digitalopportunity.org/external/?url=http%3A%2F%2Fportal.unesco.org%2Fci%2Fev.php%3FURL_ID%3D6926%26URL_DO%3DDO_TOPIC%26URL_SECTION%3D201%26reload%3D1041834627*.

A programme in Ethiopia to support training for the blind and visually impaired through ICTs.

"Evaluation Report on UNESCO's Community Multimedia Centre Initiative(CMC)." May 22, 2006. Internal Oversight Service, Evaluation Section: UNESCO. *http://portal.unesco.org/ci/en/files/22129/11477736959CMC_Evaluation_Final.pdf/CMC%2BEvaluation_Final.pdf*.

An assessment of UNESCO's CMC initiative which promotes sustainable local development through community-based facilities that combine traditional media like radio, television, and print with new ICTs such as computers, the Internet, and mobile devices.

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The first community multimedia centre with radio and ICTs in Mozambique opened as part of UNESCO's multi-country scale-up initiative was inaugurated on May 9, 2005.

"The ICT Programme." 2006. Mauritius National Computer Board. *http://www.gov.mu/portal/site/ncbnew?content_id=04c5542c04f7d010VgnVCM1000000a04a8c0RCRD*.

An ambitious programme for training 400,000 Mauritians in ICT over four years began on September 4 in the ICT labs of 60 secondary schools across the country.

"IICD Supported Project: Kalomo Bwacha Women's ICT Club." April 2006. International Institute for Communication and Development. *http://www.iicd.org/projects/articles/iicdprojects.2006-04-25.0903449865*.

Women in a rural area of Zambia are using ICTs in a women's resource centre to improve money-making activities by using the Internet to market their produce.

Laureys, F. November 2006. "ICTs and Rural Development: a case from Burkina Faso." International Institute for Communication and Development. *http://www.iicd.org/articles/iicdnews.2006-11-06.1897137599*.

This article describes three of the five IICD supported projects in Burkina Faso focusing on rural development using ICTs

"Nigerian Government Kick Starts Computer for All Nigerians Initiative (CANi)." June 10, 2006. *Highway Africa News. http://hana.ru.ac.za/article.cfm?articleID=1180*.

The Nigerian federal government has placed an order for 14,500 units of personal computers under the CANi initiative.

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"Using Information and Communication Technology to Combat HIV/AIDS—Uganda." March 24, 2004. The Communication Initiative. *http://www.comminit.com/experiences/pds32004/experiences-1900.html*

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Report contains recommendations for a Pro-Poor ICT4D Non-Formal Education Policy.

Wambui, M. "Development Through Radio: A Case Study from Sierra Leone."2005. *The Communication Initiative. http://www.comminit.com/ict/ictcasestudies/ictcasestudies-17.html*.
The Forum of Conscience, a human rights NGO, set out to establish a Development Through Radio project in Sierra Leone that would provide a channel through which women could voice their views on the Truth and Reconciliation Commission process and bring gender issues to the fore of the process.

6. DISTANCE EDUCATION AND OPEN LEARNING

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Butcher, N. December 2003. *Technological Infrastructure and Use of ICT in Education in Africa: An Overview.* ADEA Working Group on Distance Education and Open Learning. *http://www.adeanet.org/publications/docs/ICT_eng.pdf*.
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"Developing Effective ICT-Supported Distance Education Delivery Models and Methodologies." Project dates: September 2004 to December 2005. UNESCO. *http://portal.unesco.org/education/en/ev.php-URL_ID=42892&URL_DO=DO_TOPIC&URL_SECTION=201.html*.
The project's purpose was to develop e-learning materials to improve distance education for Namibian secondary schools.

"Distance Education, Information and Communication Technologies (ICTs)– Policy Challenges." March 27–31, 2006. Association for the Development of Education in Africa, Biennale on Education in Africa held in Libreville, Gabon. *http://www.adeanet.org/biennial-2006/D.%20Doc%20Pl%E9ni%E8res/PL5_2_GTEDAL_en.pdf#search=%22%22Southern%20African%20Regional%20Distance%20Education%20Centre%22*.
Provides an insight into the status of technological infrastructure in sub-Saharan Africa needed to support distance education interventions.

"South West: UB Armed for Distance Learning." November 2006. *Cameroon Tribune*. *http://www.cameroon-tribune.net/article.php?lang=Fr&oled=j15092006&idart=38888&olarch=#*.
The University of Buea has announced its readiness to make distance learning more realistic in the next academic year.

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This report is a review of the literature on current developments and prospects in the field of open and distance learning in sub-Saharan Africa.

"Teacher Education Through Distance Learning." October 2001. UNESCO. *http://portal.unesco.org/education/en/ev.php-URL_ID=45578&URL_DO=DO_TOPIC&URL_SECTION=201.html*.
This document is a summary of case studies that include one in each of Burkino Faso and Nigeria and two in South Africa.

"Toolkit Preview: Designing Open and Distance Learning for Teacher Education in Sub-Saharan Africa: A Toolkit for Educators and Planners." March 2006. *http://web.worldbank.org/WBSITE/EXTERNAL/*

COUNTRIES/AFRICAEXT/EXTAFRREGTOPEDUCATION/EXTAFRREGTOPDISEDU/0,,contentMDK:20821714~pagePK:34004173~piPK:34003707~theSitePK:732264,00.html.
The toolkit focuses on the development of open and distance learning and teacher education programmes.
"University of Swaziland Institute of Distance Education.".*http://www.uniswa.sz/academics/ide/*.
The Web site has a summary of programmes offered.

7. GENDER AND ICT

Buskens, I. June 6. 2006. "GRACE Project : State of the Research." Durban, South Africa: Association for Progressive Communications. *http://www.apc.org/english/news/index.shtml?x=5038333*.
The GRACE (Gender Research in Africa into ICTs for Empowerment) project is focused on researching how women in 12 African countries use ICTs for empowerment.
Derbyshire, H. January 2003. "Gender Issues in the use of Computers in Education in Africa". Imfundo. *http://imfundo.digitalbrain.com/imfundo/web/learn/documents/Gender%20Report.doc*.
The paper draws on research from other jurisdictions because of the lack of African-based research.
"GenderIT.org : Changing The Way You See ICT." Association for Progressive Communications**.** *http://www.genderit.org/en/index.shtml*.
A clearinghouse on gender and ICT policy issues.
Isaacs, S. November 2002. Seoul, Korea. "It's Hot for Girls." Paper presented at Expert Group Meeting on Information and Communication Technologies and Their Impact on And Use as An Instrument for The Advancement And Empowerment of Women..*http://www.un.org/womenwatch/daw/egm/ict2002/reports/Paper%20by%20Isaaks2.PDF*.
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"Open Learning Communities for Gender Equity with the Support of ICTs." November 2003. UNESCO, Open Learning Communities. *http://portal.unesco.org/ci/en/ev.php-URL_ID=2175&URL_DO=DO_TOPIC&URL_SECTION=201.html*.
Local communities in Mozambique and South Africa use ICTs to develop their own content and learning tools using local telecentres that transform them into places of equity-based learning and community-building.
Radloff, J., N. Primo, and A. Munyua. August 2004. "The Role of Information and Communication Technologies in the Development of African Women." Association for Progressive Communications. *http://www.apc.org/english/rights/documents/article_english.pdf*.
This paper examines the role of information and communication in relation to women's development in Africa. The paper outlines the issues and challenges faced by African women entering the information society.
"Women in Global Science and Technology (WIGSAT)." *http://www.wigsat.org/WST.html*.
This site contains several references relating to women, science, technology, and ICT in development

About *info*Dev

*info*Dev is a partnership of international development agencies, coordinated and served by an expert Secretariat housed in the Global ICT Department (GICT) of the World Bank, one of its key donors and founders. It acts as a neutral convener of dialogue, and as a coordinator of joint action among bilateral and multilateral donors—supporting global sharing of information on ICT for development (ICT4D), and helping to reduce duplication of efforts and investments. To this end, *info*Dev sponsors cutting-edge research and analysis to help identify global best practice in the use of ICT4D.

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SURVEY OF ICT AND EDUCATION IN AFRICA

A Summary Report, Based on 53 Country Surveys

This project seeks to gather together in a single resource the most relevant and useful information on ICT in education activities in Africa.

Key questions:

- How are ICTs currently being used in the education sector in Africa, and what are the strategies and policies related to this use?
- What are the common challenges and constraints faced by African countries in this area?
- What is actually happening on the ground, and to what extent are donors involved?

Contents:

- ICT Policies for Education in Africa
- ICT Activities and Initiatives in Higher Education in Africa
- ICT Activities and Initiatives in Primary and Secondary Schools
- ICT Activities and Initiatives in Non-formal Education in Africa
- Gender Equity and ICT in Education in Africa
- Factors Enabling and Constraining ICT Use in Education in Africa
- ICT in Education in Africa: A Way Forward

  + Regional ICT/Education Initiatives in Africa

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