Information Technology for Africa

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Abstract

In the dawn of the 21st century - the Information Age-, Information and Communication Technologies create profound challenges and opportunities for Africa, both intra and extra continentally. This paper discusses issues affecting Information and Communication Technologies development in Africa. In recent years, Information and Communications Technologies have penetrated many sectors, however, ICT development and infrastructure in Africa is still far behind those of the developed countries due to poorly managed policies and regulations, poor infrastructure, lack of capital investment, low literacy rates, high cost of bandwidth, and social issues. The paper also discusses some prospects made in recent years to improve communication systems on the continent as well as some IT projects in Africa by the United Methodist Church.

Introduction

Information and Communications Technology (ICT) is a key factor for social and economic development; however, there exists a wide discrepancy in development and infrastructure of ICT technology between African countries and developed nations. Many people in the developed nations have easy access to information through the use of the internet, email, and telephone because of access to high performance networks which is either under-developed or non-existent in most parts of Africa. Even though information technology has started penetrating many sectors, including education, health care, business, governance, and rural development, many African countries are saddled with inadequate communications infrastructure. Improvements in the speed of the internet over the past decade as measured by Stanford University shows Africa as the region with the slowest improvements and is actually steadily falling behind the rest of the world. (1)

Providing technology and connectivity in Africa is not something a single nation or organization can do alone. All nations on the continent must come together in a collective effort to find a solution. As pointed out by Kwankam and Ningo (2) our vision should not be limited to catching up with what exists in the developed world. This will simply guarantee the propagation of the gap between them and us. Secondly, it will continue to create problems of appropriateness, adaptability, etc., which will continue to eat up our meager resources.

To avoid making Africa the dumping ground of unneeded technology, proper guidelines must be set down for equipment manufacturers, distributors, service providers and end users. Such guidelines must have the backing of government in order to be effective, and should cover:

- acquisition of information technology,
- use and application of the technology,
- human resource development, and
- regulation/deregulation and management.

Lack of infrastructure in most African countries may be seen as a disadvantage. African nations are not saddled with infrastructure built on obsolete technology that may require huge capital and extensive process to replace. A proactive approach must therefore be adopted to provide a solution that may serve the needs of the people. By simply adopting the developed world's model will not necessarily lead to equitable spread throughout society, and that the divide will be amplified between the minority elite groups and the poor masses. A customized communications strategy to allow information to reach rural, remote, cross-border and large geographic areas should be adopted by combining existing systems and technologies with new ones, where necessary, to unsure cost-effective and sustainable systems for communication.

To ensure proper implementation and development of the IT industry African nations must focus on sectors where institutional capacity already exists. Examples of such sectors are education, health, business, finance, government institutions, and the environment. A survey by Harvard University shows that access to the internet is so desirable to students in Africa that they spend considerable time and money to get it. Many students surveyed, with no internet connection at their universities, resorted to private, fee charging internet cafes to study and learn. (http://www.arp.harvard.edu/AfricaHigherEducation/Online.html)

Internet Connectivity in Africa Compared to the Rest of the World

World Internet usage statistics released by World Internet Stats shows Africa with approximately three times lower penetration than any other region. However, usage growth between 2000 and 2007 is almost 900%, making Africa a huge potential market for the internet technology.



World Internet Users December 2007

Source: www.internetworldstats.com

WORLD INTERNET USAGE AND POPULATION STATISTICS							
World Regions	Population (2007 Est.)	Population % of World	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2007	
<u>Africa</u>	941,249,130	14.2 %	44,361,940	4.7 %	3.4 %	882.7 %	
<u>Asia</u>	3,733,783,474	56.5 %	510,478,743	13.7 %	38.7 %	346.6 %	
<u>Europe</u>	801,821,187	12.1 %	348,125,847	43.4 %	26.4 %	231.2 %	
<u>Middle East</u>	192,755,045	2.9 %	33,510,500	17.4 %	2.5 %	920.2 %	
North America	334,659,631	5.1 %	238,015,529	71.1 %	18.0 %	120.2 %	
<u>Latin</u> America/Caribbean	569,133,474	8.6 %	126,203,714	22.2 %	9.6 %	598.5 %	
<u>Oceania / Australia</u>	33,569,718	0.5 %	19,175,836	57.1 %	1.5 %	151.6 %	
WORLD TOTAL	6,606,971,659	100.0 %	1,319,872,109	20.0 %	100.0 %	265.6 %	

Internet Usage Statistics for Africa

(Africa Internet Usage and Population Stats)

INTERNET USERS AND POPULATION STATISTICS FOR AFRICA							
AFRICA REGION	Population (2007 Est.)	Pop. % in World	Internet Users, Latest Data	Penetration (% Population)	% Users in World	Use Growth (2000-2007)	
<u>Total for Africa</u>	941,249,130	14.2 %	44,234,240	4.7 %	3.5 %	879.8 %	
Rest of World	5,665,721,036	85.8 %	1,217,798,457	21.5 %	96.5 %	241.6 %	
WORLD TOTAL	6,606,970,166	100.0 %	1,262,032,697	19.1 %	100.0 %	249.6 %	
Source: <u>www.internetworldstats.com</u>							



Source: www.internetworldstats.com

INTERNET USAGE STATISTICS FOR AFRICA						
<u>AFRICA</u>	Population (2007 Est.)	Internet Users Dec/2000	Internet Users, Latest Data	% Population (Penetration)	(%) Users in Africa	Use Growth (2000-2007)
<u>Algeria</u>	33,333,216	50,000	2,460,000	7.4 %	5.6 %	4,820.0 %
<u>Angola</u>	12,263,596	30,000	172,000	1.4 %	0.4 %	473.3 %
<u>Benin</u>	8,078,314	15,000	700,000	8.7 %	1.6 %	4,566.7 %
<u>Botswana</u>	1,815,508	15,000	60,000	3.3 %	0.1 %	300.0 %
<u>Burkina Faso</u>	14,326,203	10,000	80,000	0.6 %	0.2 %	700.0 %
<u>Burundi</u>	8,390,505	3,000	60,000	0.7 %	0.1 %	1,900.0 %
<u>Cameroon</u>	18,060,382	20,000	370,000	2.0 %	0.8 %	1,750.0 %
<u>Cape Verde</u>	423,613	8,000	29,000	6.8 %	0.1 %	262.5 %
<u>Central African Rep.</u>	4,369,038	1,500	13,000	0.3 %	0.0 %	766.7 %
<u>Chad</u>	9,885,661	1,000	60,000	0.6 %	0.1 %	5,900.0 %
<u>Comoros</u>	711,417	1,500	21,000	3.0 %	0.0 %	1,300.0 %
<u>Congo</u>	3,800,610	500	70,000	1.9 %	0.2 %	13,900.0 %
Congo, Dem. Rep.	68,008,922	500	180,000	0.3 %	0.4 %	35,900.0 %
Cote d'Ivoire	18,373,060	40,000	300,000	1.6 %	0.7 %	650.0 %
<u>Djibouti</u>	496,374	1,400	11,000	2.2 %	0.0 %	685.7 %
Egypt	80,335,036	450,000	6,000,000	7.5 %	13.6 %	1,233.3 %
Equatorial Guinea	551,201	500	8,000	1.5 %	0.0 %	1,500.0 %

<u>Eritrea</u>	4,906,585	5,000	100,000	2.0 %	0.2 %	1,900.0 %
<u>Ethiopia</u>	76,511,887	10,000	164,000	0.2 %	0.4 %	1,540.0 %
<u>Gabon</u>	1,454,867	15,000	81,000	5.6 %	0.2 %	440.0 %
<u>Gambia</u>	1,688,359	4,000	58,000	3.4 %	0.1 %	1,350.0 %
<u>Ghana</u>	22,931,299	30,000	609,800	2.7 %	1.4 %	1,932.7 %
<u>Guinea</u>	9,947,814	8,000	50,000	0.5 %	0.1 %	525.0 %
<u>Guinea-Bissau</u>	1,472,780	1,500	37,000	2.5 %	0.1 %	2,366.7 %
<u>Kenya</u>	36,913,721	200,000	2,770,300	7.5 %	6.3 %	1,285.2 %
<u>Lesotho</u>	2,125,262	4,000	51,500	2.4 %	0.1 %	1,187.5 %
<u>Liberia</u>	3,195,931	500	1,000	0.03 %	0.0 %	100.0 %
<u>Libya</u>	6,036,914	10,000	232,000	3.8 %	0.5 %	2,220.0 %
<u>Madagascar</u>	19,448,815	30,000	110,000	0.6 %	0.2 %	266.7 %
<u>Malawi</u>	13,603,181	15,000	59,700	0.4 %	0.1 %	298.0 %
<u>Mali</u>	11,995,402	18,800	70,000	0.6 %	0.2 %	272.3 %
<u>Mauritania</u>	3,270,065	5,000	30,000	0.9 %	0.1 %	500.0 %
<u>Mauritius</u>	1,250,882	87,000	300,000	24.0 %	0.7 %	244.8 %
<u>Mayotte (FR)</u>	208,783				-	n/a
<u>Morocco</u>	33,757,175	100,000	6,100,000	18.1 %	13.8 %	6,000.0 %
<u>Mozambique</u>	20,905,585	30,000	178,000	0.9 %	0.4 %	493.3 %
<u>Namibia</u>	2,055,080	30,000	80,600	3.9 %	0.2 %	168.7 %
<u>Niger</u>	12,894,865	5,000	40,000	0.3 %	0.1 %	700.0 %
<u>Nigeria</u>	135,031,164	200,000	8,000,000	5.9 %	18.1 %	3,900.0 %
Reunion (FR)	802,911	130,000	220,000	27.4 %	0.5 %	69.2 %
<u>Rwanda</u>	9,907,509	5,000	50,000	0.5 %	0.1 %	900.0 %
<u>Saint Helena (UK)</u>	7,543		1,000	13.3 %	0.0 %	0.0 %
Sao Tome & Principe	199,579	6,500	29,000	14.5 %	0.1 %	346.2 %
<u>Senegal</u>	12,521,851	40,000	650,000	5.2 %	1.5 %	1,525.0 %
<u>Seychelles</u>	81,895	6,000	29,000	35.4 %	0.1 %	383.3 %
<u>Sierra Leone</u>	6,144,562	5,000	10,000	0.2 %	0.0 %	100.0 %

<u>Somalia</u>	12,448,179	200	94,000	0.8 %	0.2 %	46,900.0 %
South Africa	43,997,828	2,400,000	5,100,000	11.6 %	11.5 %	112.5 %
<u>Sudan</u>	39,379,358	30,000	3,500,000	8.6 %	7.9 %	11,566.7 %
<u>Swaziland</u>	1,133,066	10,000	41,600	3.7 %	0.1 %	316.0 %
<u>Tanzania</u>	39,384,223	115,000	384,300	1.0 %	0.9 %	234.2 %
<u>Togo</u>	5,701,579	100,000	320,000	5.6 %	0.7 %	220.0 %
<u>Tunisia</u>	10,276,158	100,000	1,618,440	15.7 %	3.7 %	1,518.4 %
<u>Uganda</u>	30,262,610	40,000	750,000	2.5 %	1.7 %	1,775.0 %
<u>Western Sahara</u>	382,617					0.0 %
<u>Zambia</u>	11,477,447	20,000	500,000	4.4 %	1.1 %	2,400.0 %
<u>Zimbabwe</u>	12,311,143	50,000	1,220,000	9.9 %	2.8 %	2,340.0 %
TOTAL AFRICA	941,249,130	4,514,400	44,234,240	4.7 %	100.0 %	879.8 %

Source : www.internetworldstats.com

Factors Affecting IT Development in Africa

Although there is now growing recognition of the far-reaching impact of telecommunications and networking on the economies of African countries, a number of problems restrict its diffusion through public institutions. Shortage of financial and human resources, lack of knowledge on the availability of potential tools, low level telecommunications infrastructure, strict government regulations and monopoly, high cost of bandwidth, low literacy levels, socio-economic and cultural issues, high cost of commercial licensed software, and rapid changes in technology are all affecting information technology development in Africa.

Low level infrastructure

Underdevelopment of the telecommunication infrastructure remains one of the major problems in I.C.T. development in Africa. Telecommunications diffusion in Africa is the weakest in the world with the least tele-density. The low density of I.C.T. infrastructure, congestion, and costs are significant impediments to technology usage. As a result, I.C.T. access and user exposure to technology are limited. A majority of the users depend on public cyber cafés or institutions for access to the Internet and e-mail.

Government regulations and monopoly

Liberalization of the I.C.T. sector in most African countries in the last 10 years has led to a rapid growth in some areas in technology, especially the cell phone technology. However, there are still some countries where the government has a tight grip over regulatory issues by imposing high tariffs and complete monopoly over the telecommunication sector. As a result, user exposure to technology is limited. Telecom policies vary considerably in Africa. The tariff is several folds that of the developed world. Telecom policies have become not only rigid but also have evolved as a perceived threat to socio-economic development. Even under connection queues for three to four years in some countries in Africa and telecom profitability at a very high margin, the inadequate policies and incompetence of telecommunications management in most countries blocks achievement of the right to communicate, socio-economic development and universal access. For example, Africa University in Zimbabwe uses VSAT for its internet connectivity and pays \$7,500 a month for 1024KB downlink and 512KB uplink bandwidth because they could not acquire the license to operate a satellite dish directly.

High cost of bandwidth

Another major factor limiting accessibility is the high cost of international connections to the global telecommunication backbones. For those universities, research centers, and libraries that can afford internet connectivity, bandwidth costs are usually thousands of times higher than for their counterparts in the developed world. All the universities of sub-Saharan Africa, taken together, pay over \$3 million per month in connectivity. Due to lack of national and international optic fiber backbones, most countries in Africa depend on satellite technology for connectivity.

Low literacy levels

Information users in Africa have the lowest literacy levels. More than half of Africa's population is illiterate. Over half of those literate cannot gather information for problem solving due to lack of resources and appropriate technology.

Socio-economic and cultural issues

Most users struggle with everyday life. The availability of hundreds of local languages without interface to global knowledge resources has made access to information more difficult. The near absence of an information seeking culture has continued to impede progress towards achieving universal access. Blind deployment of technology without complete evaluation of factors that influence user acceptance behavior is one of the major issues that need to be addressed because of the

region's unique culture. Socio-cultural settings, accessibility, availability of infrastructure, are important factors in technology acceptance and account for variation in user behavior. The fact that the internet provides a rich source of information and it is effective for communication does not mean we should focus mainly on the internet based technology. After all, how many people have the luxury of one meal a day, not to talk of the luxury of electricity and clean water. Introduction of new technologies and the efficiencies that are meant to come with them require the hiring of expatriates. In most parts of Africa, issues of tribal affiliation often create skepticisms which lead to resistance and underutilization of such new technologies. Users tend to be more satisfied with technology adapted to their culture. (3)

Open Source Software Development and Usage in Africa

One area that may have a big impact on Information Technology in Africa is Open Source Software. The use of Open Source Software will help bridge the technological gap at an acceptable cost. Open Source Software (OSS) development and usage continues to grow in Africa as institutions look for viable alternatives to expensive proprietary software. Governments in Africa must consider Open Source Software as a serious alternative to commercial licensed software just as Brazil did in 2000, not only as site for implementation for the software, but more importantly as propagators of the philosophy behind the Open Source movement.

In adopting the Open Source approach, governments, organizations and end users must ensure that the implementations will produce value. They should also ensure that they have adequate capacity to implement, use and maintain and have meaningful and strong policy support. There are several initiatives to promote the use of Open Source Software.

The Free Software and Open Source Foundation for Africa (FOSSFA) (http://www.fossfa.net) was launched on 21st February 2003 in Geneva during the WSIS PrepCom2 meeting. The Foundation's work was to focus on three thematic areas:

- 1. Open Source in Government
- 2. Open Source in Health
- 3. Open Source in Education

Free and Open Source Software benefits, among others will include:

- Reduced costs and dependency on imported technology and skills.
- Affordable software for individual, enterprise and government.
- Access to government data without barrier of proprietary software and formats.
- Ability to customize software to local languages and cultures.
- Lowered barriers to entry for software business.

The RULE (Run Up to-date Linux Everywhere (http://www.rule-project.org) project is aimed at creation of a very light Linux distribution for schools and other organizations in developing countries that cannot afford modern computers systems. The Ubuntu, sponsored by Canonical Ltd, owned by South

African entrepreneur Mark Shuttleworth . (http://www.ubuntu.com) aims at providing an upto-date yet stable operating system for the average user, and features a strong focus on usability, regular releases, and ease of installation.

African Virtual Open Initiatives and Resources – AVOIR (http://avoir.uwc.ac.za) project is an initiative that is developing open source software engineering capacity through a network of African universities to support capacity building in Free and Open Source software engineering.

Open Medical Record System (OpenMRS) (http://openmrs.org) is a community-developed, opensource, enterprise electronic medical record system framework intended to aid resource-constrained healthcare environments.

To date, OpenMRS has been implemented in several African countries, including South Africa, Kenya, Rwanda, Lesotho, Zimbabwe, Mozambique, Uganda, and Tanzania Aspiration project (http://www.aspirationtech.com) connects and strengthens virtual communities of nonprofit users and developers through the *Social Source Commons*, a platform which maps out and documents available software tools and related information resources for nonprofit and profit organizations.

The Prospects for Fiber Optics Initiatives in Africa

Several initiatives have been taken to connect the African continent with submarine fiber optic cables to enable Africa countries to have access to the international telecommunication market The first of such initiatives is Southern Africa Telecommunication/West Africa Submarine Cable/ South Africa-Far East Project (SAT3/WASC/SAFE) (4) which is a large-scale international fiber link in Africa which connects the continent to Europe and the Far East. The SAT-3/WASC's first segment connects Portugal to the Cape in South Africa, reaching eight costal countries along the way: Senegal, Ivory Coast, Ghana, Benin, Nigeria, Cameroon, Gabon and Angola. A second section, in the Indian Ocean, connects South Africa to Malaysia while passing through Mauritius and India (SAFE). This project is expected to bring down bandwidth cost; however, this has failed to achieve the desired results because it is operating as a cartel of monopoly state-owned telecommunication providers who charge exorbitant prices. It is estimated that only 5% of the potential SAT-3 capacity is currently being used. The SAT-3 consortium made its money back in five years because it chose to sell low volumes of the bandwidth at high cost.(5)



A new project, the *Eastern Africa Submarine Cable System* (EASSy) to connect countries of eastern Africa via a high bandwidth fiber optic cable system to the rest of the world is under way and is expected to be completed by late 2008. EASSy is planned to run from Mtunzini in South Africa to Port Sudan in Sudan, with landing points in six countries, and connected to at least five landlocked countries. The 9 900km EASSy cable will complete the fiber loop surrounding Africa thereby eliminating the reliance on expensive satellite systems to carry voice and data services. It is considered a milestone in the development of information infrastructure in the region. The implementation of the project is slow and is causing frustration among some governments in the region because stakeholders, investors and governments are divided on the issue of access and pricing. Telkom, a major EASSy stakeholder, has threatened withdraw from the project, as it may be forced to reduce the fees it charges rival operators to use its bandwidth on SAT-3.

Since its inception in 2002, The SAT/WASC/SAFE project has created many opportunities for African countries. The project enhanced access to Information Communication Technology (ICT) services among the beneficiary nations. For example, increased access to bandwidth on the broadband Internet has enhanced speed of transmission of data, voice and other interactive multimedia applications in countries like Cameroon, Ghana, Nigeria and Senegal. According the International Financial Corporation research, the SAT/WASC has created an enabling environment for the four countries, allowing for achievements in network consulting, system administration, software production, and data processing industries, among others.(6) Despite the advances in fiber connectivity in recent years, the cost of bandwidth still remains high because the projects are

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controlled by a cartel of private and state-owned communication providers who maintain a tight monopoly over its operations.



(http://www.nokiaphoneblog.com) The East African Submarine System and access loops to landlocked countries Source: WBG Regional Communications Infrastructure Briefing Note, Sept., 2005

Mobile Phone Technology Improves Communication in Africa.

In a two-day summit on improving Africa's information technology infrastructure held in Rwanda recently, Hamadoun Touré, the Secretary General of the United Nations International Telecommunication Union (ITU) emphasized that African leaders are now creating the right regulatory environment.(7) One area that is seeing dramatic improvement is the mobile phone technology. In the past few years Africa has seen a dramatic jump in telephone density. In the past three years, Africa has had the highest growth in mobile use globally which is estimated to be twice the global average.

According to 2006 Cell Phone Statistics published by Times of Refreshing Ministries (8), out of the 2.4 billion cell users in the world, 59 percent of them live in developing countries, making cell phones the first telecommunication technology in history to have more users there than in the developed world. In Africa, there are 94 new subscribers per minute compared to 46 new subscribers per minute in North America.

United Methodist Church Information Technology Projects in Africa

A pilot project in Mozambique, sponsored by the General Board of Higher Education and Ministry, in co-operation with United Methodist Communications, is scheduled to start operation in March 2008 with Africa University serving as the anchor institution to offer online courses in MBA, CISCO Network Training, and Basic Computer Literacy (popularly known in Africa as International Computers Driver's License (ICDL)). Phase I which consists of a computer/classroom lab with 15 workstations and a server, audio visual equipments, networking equipments, a library with 3 workstations, internet connectivity using VSAT technology are in place. In addition the entire office building of the Annual Conference has been networked. In co-operation with United Methodist Communications, the Annual Conference will have their own domain name and a web server to publish activities of the Annual Conference. A mail server to provide the staff with individual email addresses to facilitate intra/inter office communication has also been set up.



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Phase II of the project will provide video conferencing capabilities, VOIP telephony, and also connect the other church centers in the Annual Conference. Feasibility studies for a similar project have been completed in Cote d'Ivoire, Nigeria, Sierra Leone, Liberia, and the Democratic Republic of Congo. A visit to Angola and East Africa has been planned to conduct similar feasibility studies.



Mozambique Distance Learning Project. Network Topology Layout : Phase II

Through the initiatives of the MGEFLD, and when funds are available, similar infrastructure as in Mozambique will be set up in the various Annual Conferences to get them all wired and connected and be ready to offer online courses in Pastoral Training, Leadership Training, English as a Second Language and other relevant academic courses with Africa University serving as the anchor institution. Church activities in Africa with regards to education have in the past, by other denominations, been focused on the "brick-and-mortar" type of set up. In this age of Information Technology, the directions taken by the church to reach a broader audience to fulfill its mission and objectives through the use of technology will have a significant impact on improving information technology in Africa.



Conclusion

Challenges of the information age revolve around the twin concepts of globalization and the information age which embody social, economic, political, technical, and cultural processes and access to Information Technology (IT) and Information and Communication Technology (ICT), and policy development in general. The ICT problems in Africa and their solutions vary from country to country, therefore, countries must work together to find a way of improving ICT developments in Africa. Countries must come out with clear policies in order to incorporate the development of ICTs successfully into national strategic plans which will lead to improvements in the infrastructures and easy access. Any effort to improve the ICT infrastructure in Africa must focus first on the development of the telecommunications infrastructure as seen from the various submarine fiber connectivity projects.

High bandwidth cost remains a major problem despite recent advances in various fiber connectivity projects. Efforts should be made to break the tight monopoly held by various telecommunication companies and governments to allow expanded access to this infrastructure, thereby, reducing dependency on satellite technology.

Use of Open Source Software will help bridge the technological gap at an acceptable cost. Governments in Africa must consider Open Source Software as a serious alternative to commercial licensed software, not only as site for implementation for the software, but more importantly as propagators of the philosophy behind the Open Source movement.

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