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The future of ICT in developing world: Forecasts on sustainable solutions for global development

Tella, Adeyinka*

Olorunfemi, Doreen Yemisi Oluyemisi**

ABSTRACT

Information communication technologies (ICTs) offer great promise for eradicating poverty, developing our communities and integrating them into the global economy, not merely of products and services but also of knowledge. In all sorts of ways, integrating different types of media increase the speed of communication while lowering its cost. It facilitates dialogue, bridging the enormous divide in information and access to healthcare between rural and urban communities. ICT can bring our poorest schools and communities into the growth orbit of our rural areas. With all these advantages and benefits of ICT, this paper presents discussions on the future of ICT in developing world. Issues considered in the paper include: the future of ICT in the developing world: connectivity, use, and affordability; plans for connectivity: Government, Business; connectivity in rural areas-trends; rural Dwellers and Connectivity by 2030; constraints to connectivity in developing world; good practices; and practical tips to improve connectivity in the developing world.

Keywords: ICTs, Connectivity, Rural Dwellers, Poverty Eradication, Global Economy, Developing Countries, Developing World.

INTRODUCTION

All over the developing world, ICT is no longer just an option. It is a necessary component of education in development. It offers us increasingly powerful capacities. We need to embrace these capacities in a way that involves all our people. ICT can enable people to make a better living for themselves, but it is also opens domain for political participation, channels of communication, and a ways for people to better understand each other. If we manage our computerization efforts intelligently, and keep foremost the humane and political goals which motivated us to computerize in the first place, we will find our communities strengthened rather than weakened, united rather than divided by it. Information and communication technologies (ICT) have the potential to offer vast advantages to users. ICT could bring broad and in-depth information to those who have been hitherto denied such knowledge and thus

Author's Affiliations: *Lecturer 1, Faculty of Communication and Information Science, Department of Library and Information Science, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria, **Librarian, Michael Adekunle Ajasin University Library, Akungba, Ondo State, Nigeria

Reprints Requests: Tella, Adeyinka
Lecturer 1, Faculty of Communication and Information Science, Department of Library and Information Science, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria, E-mail: tella.a@unilorin.edu.ng.

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opportunities for social and economic mobility.

It is believe that the new technologies offer great promise for eradicating poverty, developing our communities and integrating them into the global economy, not merely of products and services but also of knowledge. In all sorts of ways, by integrating different types of media, increasing the speed of communication while lowering its cost, by facilitating dialogue, by bridging the enormous divide in information and access to healthcare between rural and urban communities, ICT can bring our poorest schools and thus our poorest communities into the growth orbit of our rural areas. With all these advantages and benefits of ICT, this paper presents discussions on the future of ICT in developing world. Other issues the paper considers include: the future of ICT in the developing world: connectivity, use, and affordability; plans for connectivity: Government, Business; trends of connectivity in rural areas; rural dwellers and connectivity by 2030; constraints to connectivity in developing world; good practices; and practical tips to improve connectivity in the developing world.

AFRICA CONTINUES TO LAG BEHIND OTHER REGIONS IN OVERALL ACCESS TO ICT'S, PERTICULARITY IN RURAL AND REMOTE AREAS (ITU, 2007)

Developing countries are entering a new era of communications that will be characterized by "hyper-connectivity." In this era, millions of people and billions of things will be connected to an intelligent, secure and pervasive mobile broadband network. Hyper-connectivity goes well beyond cell phones, PDAs and laptops being connected to a network and extends to hundreds of devices such as cars, home appliances and medical instruments – anything that is IP-enabled. This sub-heading will discuss issues of connectivity, use and whether or not ICT is affordable in the developing world today and fast forward to the future.

Affordability- In term of ICT affordability in Africa, Internet access costs for example are high. Other situation reflects the following:

- Telecoms costs up to half of an ISPs operating costs
- International leased line tariffs can be up to 10 times higher than rates available from alternative satellite providers, broadband connections up to 100 times North American/ European tariffs
- High tariffs for leased lines discourage ISPs from establishing multiple links - restricted national peering and few regional links between neighboring countries, only from Senegal to Gambia, Mali, Cameroon, & links from South Africa to 3 neighbours
- Local call tariffs average $2.5/hr, in 10 countries charges are more than $4/hr and some are $6/hr
- The trend of affordability particularly on GSM local call charges are increasing, although some countries have adopted given discount for IP calls (Abi, Heeks and Whalley, 2008; Jensen, 2000).

Africa is the fastest-growing mobile market in the world, having leaped from 16 million mobile subscribers in 2000 to 198 million in 2006. This strong growth is expected to continue, with a projected 278 million subscribers in 2007. However, this growth has taken place mainly in urban areas. Despite high growth rates in mobile access, Africa continues to lag other regions in overall access to ICTs, particularly in rural and remote areas (ITU, 2007).

PLANS FOR CONNECTIVITY

Business

The world's developing nations need to regard information and communication technology (ICT) as the key driver for economic growth. ICT can make a real difference to the speed of development, but only if public and private sector co-operate: "More attention needs to be paid to the role ICT can play in raising social and economic standards in the developing world….If the develop world's governments and technology firms continue to work apart, then only slow progress will be made….Partnering public and private sector on compelling ICT initiatives in developing nations can have more of a powerfull impact on the socio-economic structure of a country than having vendor and governments doing it alone" (Barton, 2006).

A large number of governments and aid organizations are taking positive steps to bridge the digital divide. However, initiatives from business are being put in place, because business driven activities have great potential as part of development plans and strategies. The emerging economies need to develop their own digital industries that can catalyse the growth of business, government, health and education infrastructures.

Some initiatives are now being taken by some municipalities to establish public Internet services, telecentres and the rest as part of the plan to increase connectivity in the developing world where most of the rural areas are situated. From observation, most of the rural areas in the world are found in the continent of Africa and Asia. In the light of this, these two continents will be mostly referred to in this paper.

For example, at NITDA in Nigeria (Cottrell and Canessa, 2003), satellite connection is offered to serve the Capital's main offices, as well as Mobile Internet Units (MIU). This is part of a development project on computer-mediated education for school teachers and students in rural and urban marginalized communities (Cottrell and Canessa, 2003**)**. To overcome insufficient or non existing basic telecommunication services in the region, computer networks powered by solar panels or renewable energy are also growing, since there is a large demand to communicate and improve healthcare and sustainable development. Detail about the connectivity in different developing countries across the world particularly in Africa and Asia are discussed here.

In South Africa, there are three regulatory social initiatives that have contributed to the increase in connectivity and extended participation by new players. They are: imposition of license obligations, establishing a convergence regulator, creating a specialist universal service agency, rolling out telecentres, issuing licenses in under-serviced areas, establishing phone shops and other telecom related projects and programs (Barendse, 2004).

Imposing license obligations is one of the first major initiatives undertaken by the South African government as a means of increasing access to ICT infrastructures. The license conditions were intended to oblige the operators to expand the telecom network according to specified parameters. In the South Africa instance obligations were placed on both the mobile operators and the incumbent fixed operator. The tasks of auditing the targets (annually) as well as administering the associated penalties were given to the newly created regulatory authority.

A second major initiative undertaken by the South African government was the setting up of a converged regulator as a means of ensuring economic, social and technical regulation. The Independent Communications Authority of South Africa (ICASA) was established to regulate the telecom and broadcasting industry. ICASA was established to merge the previously independent broadcasting and telecom authorities and to regulate the sector (including content) as a technology converged sector. In terms of its mandate, ICASA grants licenses in the telecom and broadcasting industries and sets the terms and conditions of every license granted (Types of licenses includes frequency license, telecom services licenses and broadcasting licenses) (Barendse, 2004). In terms of its scope, ICASA makes rules and regulations that governs the two sectors as well as monitors the activities of licenses to enforce compliance with these rules. ICASA fulfills its functions through regulations and other means. ICASA regulates the telecom and broadcasting industries in the public interest.

Key functions include the following: make regulations and policies that govern broadcasting and telecom; issue licenses to providers of telecom services and broadcasters; monitor the environment and enforce compliance with rules, regulations and policies; hear and decide on disputes and complaints brought by industry or members of the public against licensees; plan, control and manage the frequency spectrum and protect consumers from unfair business practiced, poor quality services and harmful or inferior products. Other responsibilities include: promote the attainment of universal service and access by putting requirements in operators license to roll out services in under serviced area; ensure that licensees contribute to the Universal Service Fund; ensure that the relevant and broadcasting services are extended to all citizens; promote and encourage the ownership and control of telecom and broadcasting services by people from historically disadvantaged groups.

The third major initiative undertaken by the South African government was the setting up of a specialist agency with the task of facilitating the achievement of affordable universal service. The Universal Service Agency (USA) was established as a statuary body by the [Telecommunications Act, 1996] and launched in May 1997. In terms of the Act, the agency was set up to promote the goal of universal service; encourage, facilitate and offer guidance in respect of any scheme to provide universal access or universal service; foster the adoption and use of new methods of attaining universal access/service; and stimulate public awareness of the benefits of telecom services. Other tasks included in the Act were monitoring the progress of universal service; advising the Minister; and implementing projects that stimulate public awareness of the benefits of telecom services to under-serviced areas. It was also expected to manage a newly established Universal Service Fund.

In Uganda (Farrell, 2007) summarizes the current and recent ICT initiatives and projects to increase connectivity to include:

1. Providing donated computers to schools plus capacity-building support to recipient local partners.

- *Organisation(s)/funding sources:* World Computer Exchange in partnership with local organisations.
- *Geographic scope and time frame:* National

2. The Village Phone Project provides micro loans to eight local businesses to enable establishing a community phone service and testing of additional technologies.

- *Organisation(s)/funding sources:* Grameen Foundation in partnership with MTN Uganda
- *Geographic scope and time frame:* Started in 2003 in selected communities; ongoing.
- *Contact:*

3. I-Network Uganda is a national network of individuals and organisations that act as a platform for sharing knowledge and

information on applying ICTs. One of its programmes, DistrictNet, focuses on providing public information using ICTs.

- *Organisation(s)/funding sources:* ICT4D practitioners including IICD project partners; policy makers such as ministries; students and teachers; NGOs; rural communities
- *Geographic scope and time frame:* National; over 700 registered members from the public, private, and civil society sectors. Begun in 2002 and it still ongoing.

4. The spread of mobile phones and FM radio stations has enabled the development of an interactive public discussion forum in local languages on topics such as politics, health issues, agriculture, education, gender issues, and the environment.
   - *Organisation(s)/funding sources:* Over 100 FM radio stations
   - *Geographic scope and time frame:* National and still ongoing.
5. Uconnect is a non-profit NGO that aims to advance public education by using ICT to improve the quality and efficiency of communications. Activities focus on providing computer connectivity and training for schools and recently on providing ICT training to officials of 22 mostly rural districts.
   - *Organisation(s)/funding sources:* More than 225 schools have benefited to date and 22 district offices have been connected to the Internet. Multi-sponsors are involved such as telecom, hardware, learning software, transportation, and Internet provider companies.
   - *Geographic scope and time frame:* National; began in the late 1990s and continues to thrive.
6. The Uganda Ministry of Education and Sports is taking several initiatives over the next year as part of its policy implementation agenda. Examples include providing equipment and training to selected schools, providing Microsoft software to government-aided secondary schools, and including the approval of a curriculum for ICT training for secondary schools.
   - *Organisation(s)/funding sources:* The ministry has allocated some funds for these initiatives and is discussing provision of additional support with various donors.
   - *Geographic scope and time frame:* National; 2006-2007.
   - *Contact:* ICT Co-ordinator, Ministry of Education and Spor
7. The Reflect ICT resource centre has been equipped with computers (Internet connected), printers, digital camera and video, generator, UPS, public address system, WorldSpace radio, and solar-operated radios, along with other office equipment including a photocopier. The aim is to facilitate access to agricultural, health, and commercial information based on needs that the community identified.
   - *Organisation(s)/funding sources:* DIFD, and community contributions.
   - *Geographic scope and time frame:* The project is located in Bukuuku sub-county in Kabarole district, western Uganda.
   - *Contact:* http://217.206.205.24/Initiatives/ict/home.htm
8. ICT maintenance facilities for rural Uganda have been established at five technical colleges. An ICT maintenance facility was set up at each college to provide technical support and to introduce a new course called ICT Installation and Maintenance to train technicians.
   - *Organisation(s)/funding sources:* The Uganda Institute of Information and Communications Technology, established by Uganda Communications Commission, manage the project with the support of the International Institute for Communication and Development.

- *Geographic scope and time frame:* The five UTCs are located in or near upcountry towns and are geographically well distributed throughout the country. Launched in 2005; and still ongoing.

9. The British Council has launched a project to link schools in Uganda to other schools in Africa and the UK. The project code-named Connecting Classrooms with the aim to coordinating ICT, science, vocational skills, global citizenship, and cultural science in the schools.

- *Organisation(s)/funding sources:* The British Council
- *Geographic scope and time frame:* Limited number of schools; 2006-2007.

In Zambia, Macha a rural place in Southern Province of Zambia is set to improve the provision of Internet service to the community. The project which started in 2004 is run by the Macha Mission Hospital and the Malaria Institute at Macha (MIAM). This has added a new life to many people around the area. In the initial stage it began with the involvement of the Bishops of the church, chief Macha, the community members, and the government officials. The project coordinator Gertjan Stam says local people were trained and empowered in Information and Communication Technologies (ICTs); a process that took one year to be completed. Local communities were trained in the basic use of the computers and website designing. The study and testing of solutions took two years to be completed. Connectivity in Macha is now operational as there are two VSAT connections, diverse routing, LAN and distributed WLAN with 75 users. The project has 100 computers and is growing rapidly, with two network servers, content filtering (spam), proxy, firewall, virus scanning, FTP, file sharing, network printing, web server (10 websites and growing), content management (Blogging), network and system management, traffic prioritisation, and a SQL database. To most people in this area, connectivity is not a strange word as they also have a community centre, computer workshop, trained IT experts in hardware, network maintenance, web design, and application programming (Sinkondyobwe, 2006). The connectivity has enabled the hospital to applying e-health which is trickling down to the rural community in accessing good health care. It is now easier for the mission hospital to communicate with other hospitals throughout the world for data collection, information exchange, and network management. The connectivity has provided further support for ICT implementations in other rural areas such as the Kaleni Mission Hospital and Mukinge Mission Hospital in North-western province of Zambia.

In Asia, Lao PDR, a current project has begun with wiring some four or five schools. In Cambodia, the introduction of computers in a rural school is being helped through solar energy-run panels in order to reach an area without electricity. Many schools have received donated computers, often which are not functioning properly. In Viet Nam, the World Computers Exchange and SIEMENS have introduced a project that will equip many schools with second hand computers, while in the Solomon Islands and other Pacific Islands, the main concern is to connect with e-mail and the Internet and to install telecommunications. Bangladesh has also announced that it has acquired 10,000 computers to equip schools, many of which are girls' schools. An indicative example of ICT penetration in these countries is from Viet Nam, where statistics from studies reveal that only 2.59% of lower secondary school students and 11.52% of upper secondary school students are trained in ICT. Clearly, these countries still have a long way to go in terms of ICT accessibility and connectivity (UNECO, 2003).

In Malaysia, MEWC and its predecessor Ministry, the MECM, have embarked on numerous initiatives aimed at fulfilling the national objective of ensuring equitable provision of affordable ICT

services over ubiquitous national infrastructure as set out by the CMA. Conscious that the USP programme run by the MCMC is targeted firstly at expanding access to basic telecommunications services, MEWC efforts have focused instead on expanding access to the Internet, particularly in underserved areas. Earlier efforts of the MECM tackled the basic problem of making PCs affordable. Programmes such as the Gerakan Desa Wawasan project launched in 1996, which provided village authorities with PCs, the PC ownership campaign in October 1999, which allowed citizens with children over 10 years of age to use their retirement contributions to purchase PCs, and complementary government-industry projects have helped to raise PC penetration rates. Connectivity to the Internet in rural areas was also addressed through initiatives that include the Ministry's Rural Internet Centres programme and its own Universal Service Provision programme. Launched on 3 April 2000, the Rural Internet Centres programme (RIC) was one of the earliest rural Internet initiatives launched in Malaysia. The programme was developed as a holistic approach to establishing Internet access in rural areas by addressing infrastructure needs, capacity building as well as content development. Under the RIC programme, private sector operators funded by the government provide computer equipment and Internet connectivity while the site, security and electricity are provided by local post offices. Training is also provided to the RIC supervisor and its users as part of the package. A local committee of volunteers is also tasked with the development of a local website that would showcase community products and services as well as provide content relevant to the local community. In the first phase of the project RICs were deployed in post offices in semi-rural areas that were within reach of a TM Net DSL or ISDN enabled exchange. To date, 42 Rural Internet Centres (RIC) throughout the country have been equipped with five to six PCs connected to the Internet via ADSL or ISDN. Statistics compiled in July 2004 indicate that more than 53'000 users use RIC services while more than 35'000 users have undergone training under one of the RIC training programmes since its implementation (ITU, 2004). Furthermore, a range of technologies has been employed to extend ICT services to rural and remote areas in the country. The challenges of both deploying backhaul connectivity from rural and remote sites and expanding the last mile network over a scattered population have required operators to rely on different network configurations involving a combination of technologies.

Uppal (2007) points out that it seems to be accepted wisdom that Asian nations and their major cities must be connected to the Internet and other ICTs. But it is sometimes difficult to understand why ICTs are also important for people living in rural areas. Rural dwellers are among the world's poorest people (IFAD 2001), with less access to health services, education, and clean drinking water than anyone else. Explaining the issue of connectivity In India, Uppal made reference to PAN which began a partnership with the M.S. Swaminathan Research Foundation (MSSRF) in 1997. The goal was to examine the impact of ICTs in fostering sustainable agriculture and rural development. Using a makeshift modem-and-radio set-up with a solar power back-up, five village knowledge centres (VKCs) were established in the rural areas of Pondicherry, where one out of five people live below the poverty line. The VKCs are essentially community telecentres, but combined with the proper physical and human infrastructure, they become the main channel for obtaining relevant and timely information. They provide people in rural areas with appropriate knowledge about livelihood, health and social well-being, and economic opportunities. The main impetus for developing the VKCs was to research whether ICT could be a beneficial tool for social and economic development of rural communities. MSSRF succeeded in demonstrating these benefits, particularly due to the high level of community involvement (in the community where each VKC is located, it must provide volunteer staff and

guarantee equal access to all, irrespective of their social and economic situation).

Uppal emphasized that in 5 years more than 50 000 information-shop users in a dozen communities in Pondicherry have gained access to a new wireless Internet connection. The demand for local, relevant information was relentless. People wanted to know more about government financial schemes for the poor, health care, nutrition, sanitation, employment, food prices, education, and the costs and availability of agricultural inputs such as seeds, fertilizer, and pesticides. Women, in particular, were interested in the fluctuating price of grain as female agricultural workers are partly paid in grain. With additional funding from the Canadian International Development Agency, a second phase of the project began in 2001. The goal was to enhance connectivity and assess the potential sustainability of the ICTs. Some VKCs were upgraded to test new technologies with broader bandwidth enabling such new applications as video conferencing. Other VKCs were also established, providing relevant information in the local language, Tamil. As some villagers are illiterate, information such as weather reports was downloaded as RealAudio files and played over speakers in front of the VKCs (Uppal, 2007)..

Other key example of government and international plan/initiatives for connectivity are:

- Connectivity Africa & IDRC Acacia
- CATIA – UK DfID
- IFC/World Bank ICT investment programme, small ICT fund
- DotForce – Enablis ICT fund
- Microsoft – Schools, Telecentres
- Open Society Institute (OSI) /Soros Foundation
- IICD – Netherlands/ Ghana, Uganda, Tanzania, Mali
- Italian E-govt programme – Nigeria, Mozam, Tunisia
- UNIDO /GEF rural ICTs & renewable energy in Zambia & Malawi
- NEPAD
- Intell Digital transformation, Intell's World Ahead Programme initiatives in Middle East.

CONNECTIVITY IN RURAL AREAS-TRENDS

According to Kawasumi (2000) more than 2.5 billion people – over 40% of the planet's population – live in rural and remote areas of developing countries. Egan (1996) distinguish "rural" from "remote" subscribers; the latter refers to those whose access to the telephone network is difficult due to physical "remoteness" caused by either extreme distance or terrain. According to Kawasumi (2000) rural and remote areas (or just "rural") areas exhibit one or more of the following characteristics:

- scarcity of absence of public facilities such as reliable electricity supply, water, access roads and regular transport;
- scarcity of technical personnel
- difficult topographical conditions, e.g. lakes, rivers, hills, mountains or desserts which render the construction of telecommunications networks very costly
- severe climatic conditions that make critical demands on the equipment
- low level of economic activity mainly based on agriculture, fishing, handicrafts, etc.;
- low per capita income
- underdeveloped social infrastructure(health, education, etc):
- low population density;
- very high calling rates per exchange line,

reflecting the scarcity of telephone service and the fact that large numbers of people rely on a single exchange line.

Kawasumi concludes that these characteristics make it difficult to provide public tele communications services of acceptable quality by traditional means at affordable prices, while also achieving commercial viability for the service provider.

Mishra et al., (2005) emphasized that the rural connectivity landscape in developing countries presents a contrast to urban telecommunications in the developed world. They point out that three aspects are noteworthy. First, any networking technology needs to be affordable. Lowering cost at the expense of reliability (*e.g.,* no backup equipment, intermittent connectivity) and sharing of end-user devices (*e.g.,* Grameen phone, kiosks) may be an acceptable trade-off. Second, coverage is more important than capacity. Urban settings are capacity limited. Service providers must place multiple base stations in a small area to cater to large volume of traffic. In contrast, rural settings are coverage limited. Service providers would like a single base station to cover as large a geographical area (*i.e.,* as many users) as possible. Finally, demand is difficult to forecast. There is no real measure of demand in rural areas. However a few trends point towards a latent demand and a willingness to invest in telecommunications. For example, rural spending in China has risen threefold from 1990 to 2002 while the percentage spent on telecommunications and transportation (on an absolute level) has risen from 1% of overall spending to 6% of overall spending. A similar trend is visible in Bangladesh where rural residents devote 7% of their income to telecommunications (Mishra et al., 2005).

Connectivity in some Southern regions of Sub Saharan Africa countries for example is in an early stage. In particular, sub-Saharan Africa has yet to make the kind of progress in science, technology and economy that has already been achieved in the more dynamic areas of growth (TWAS, 1999). However, from 1999 till date some developments have taken place. The limited bandwidth of the few available telecommunication lines in countries that are joining the Internet cause line congestion and make access exceedingly slow, often beyond the limit of usability. Considering the fact that about 70-80% of the people in Africa and other developing world live in rural areas, there is need to know what the connectivity in the areas is like and what are the trends. For instance in a report by ITU provided in daily telegraph the number of mobile phone users in the world soared to over 3.3 billion by the end of 2007, equivalent to a penetration rate of 49 percent (The Daily Telegraph, 2008). Africa showed the strongest gains over the past two years and more than two thirds of all mobile subscribers were from developing countries by the end of 2007. This is 'a positive trend that suggests that developing countries are catching up."

Mobile subscription growth stood at 39 percent annually in Africa between 2005-2007, and 28 percent in Asia over the same period. India and China added 154 million and 143 million new subscribers respectively. The global annual average growth rate stood at 22 percent, the ITU said. Mobile phones are eclipsing traditional fixed lines and in Africa they account for nearly 90 percent of all telephone subscribers. While developing countries have made great strides in mobile growth, a significant 'digital divide' remains for Internet use and particularly the availability of broadband connections.

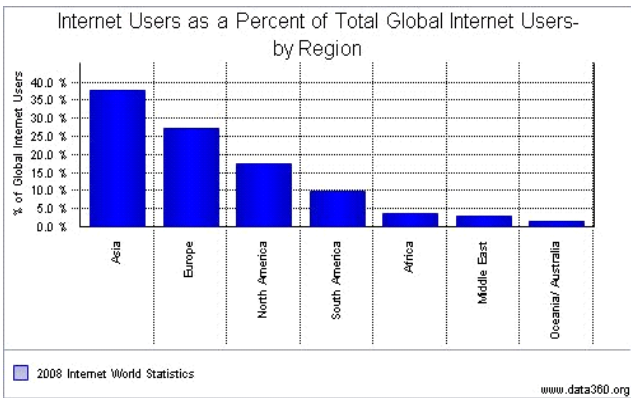
In Asia, some countries such as China, Thailand, Japan, Malaysia, The Philippines, and India, connectivity and ICT penetration is growing, but not yet to the level of the more advanced countries. In Thailand, only 22.5% of secondary schools and 1.19% of the primary schools are connected to the Internet; while the ratio of PCs per school at the secondary level is 24, and at the primary level it is only 2. Out of 358,781 primary school teachers, 71,442 have been trained and out of 125,983 secondary school teachers, 25,000: in short, only around 21% of the

teachers have received training to date (UNESCO, 2003). In the Philippines, 81% of the schools have no access to the Internet.

The integration of ICT use in the curriculum and in teaching/learning, experiences also vary. While there have been efforts to integrate the use of ICT in the teaching of certain subjects (as in the case of Malaysia, Thailand, Philippines), efforts are isolated and have not yet reached systematic nationwide proportions. Generally, teachers are using ICT mostly for word processing, for presentations and for spreadsheets. It is also usually introduced as one component or as a class period within a subject area, rather than becoming actually infused within lessons. In the Philippines, a report pointed out that currently, ICT is not integrated at all into textbooks. In India, ICT is usually taught as a separate subject, with ICT education currently being introduced through a multi-layered approach. First, ICT is integrated in textbooks for computer subjects such as Introduction to Computer Science, Informatics Practices, and ICT Systems. Similarly, ICT is used in face-to-face learning, but is not yet integrated into textbooks of specific subjects. In Thailand, ICT is used for many purposes, such as for word processing, to write and present students' work; using a spreadsheet to enter data collected in investigations, creating charts and interpreting the results; creating databases as part of investigations; using hypermedia to write, lay out and present work for publication on the Internet; and using the Internet and CD-ROMs in research and investigation. But to what extent and how widespread these functions are practiced is another issue.

The 2008 mobile phone penetration and Internet report and statistics testify to the fact that there is growth trend in connectivity around the world particularly in developing countries where most of the rural dwellers reside. Paul Budde Communication (2008) report provides an insight and analysis into the trends and developments taking place in the mobile communications sector. The report offers a wealth of information on the worldwide development of the mobile sector. Information at a regional level is also provided for the Americas, Europe, Middle East and Asia Pacific. The report includes analyses, statistics, forecasts and trends. It provides a comprehensive insight into the progress of mobile and examines some the issues and opportunities. The report reveals that in 2008 GSM technologies account for around 85% of the world's digital mobile phones, the equivalent of over 2.6 billion users. This market share is expected to grow even more due to increasing mobile penetration in the developing markets. Fig 1 shows the Internet users as percent of total global Internet users by region. The figure reveals that Asian as at 2008 has the highest number of users while Africa has the third last highest number. This is a great development considering the fact that most of the rural areas in the world where majority of people

Fig. 1



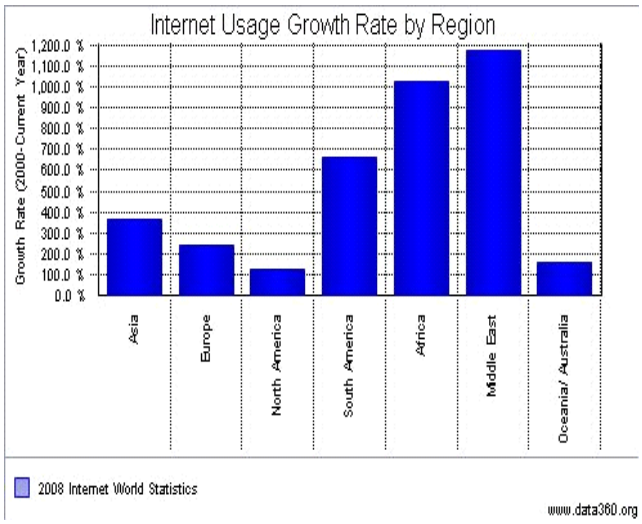
Source: Internet World Stat 2008

are living under the poverty line are situated in these two continents. Similarly, figure 2 provides additional information in support of the fact that connectivity is really growing in these two continents. The figure reveals that

Africa is the second highest region with Internet usage growth rate of 1, 000%, while Asia is fourth with 300% Internet growth rate in 2008.

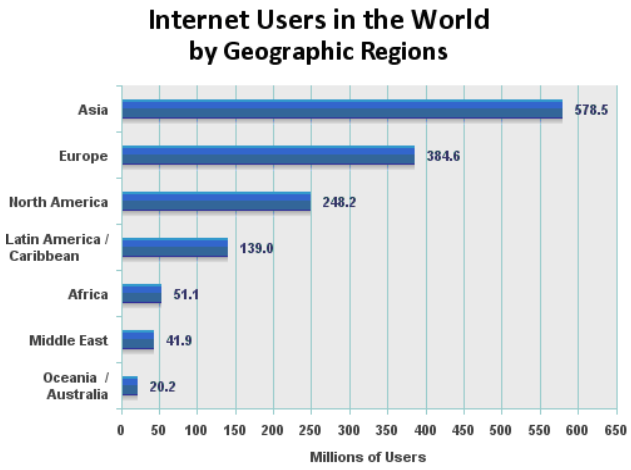
Moreover, table 1 which is on world Internet

FIG. 2



Source: Internet World Stat 2008

Fig. 3: Internet World Stats (2008) Note: An estimated Internet user is 1, 463,632,361 for Q2, 2008

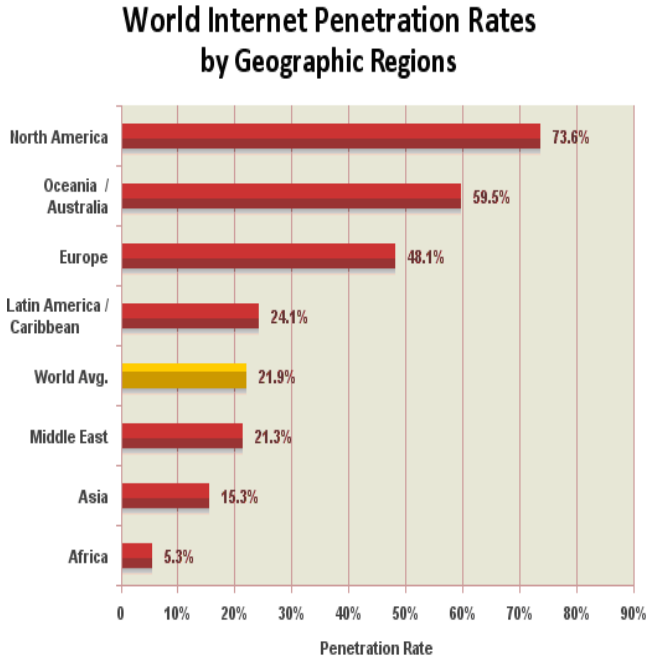


Source: Internet World Stat 2008

users and population statistics for the year 2008 reveals that usage growth rate in Africa between 2000-2008 is now 1, o31.2 % after that of the middle East which is 1, 176.8%. Though the percentage penetration in Africa is very small 5.3% (Fig. 4) however; by the year 2050 there is the likelihood that this increase in geometric rate. Fig. 3 which shows the Internet users in the world by geographic region reveal that Asian has the highest number of users estimated at 578.5% of the total world Internet users 1, 463, 632,361 with Africa rated as the 5th best with 51.1% of the same total world Internet users above the Middle East and Oceania. The data also testify to the fact the connectivity in these two regions is really growing and that people actually having increase access, if not; the number of users will not continue to be on the increase.

Aside of the above, other interesting facts to know about Africa in particular is the subscribers number and mobile phone penetration rates. Africa Telcom News (2008) released a free report called the African Mobile Factbook that gives all of the major numbers on subscribers, penetration rates, profitability and growth potential for every African carrier and country. The book revealed the underlisted:

Fig. 4: Source- Internet World Stats (2008) Note: Penetration rates are based on a world population of 6,676, 120,288 for mid year 2008 and 1,463,632,361 estimated Internet users.



- Nigeria, South Africa and Egypt are the fastest growing markets
- Africa has become the fastest growing mobile

Table 1: World Internet Users and Population Statistics

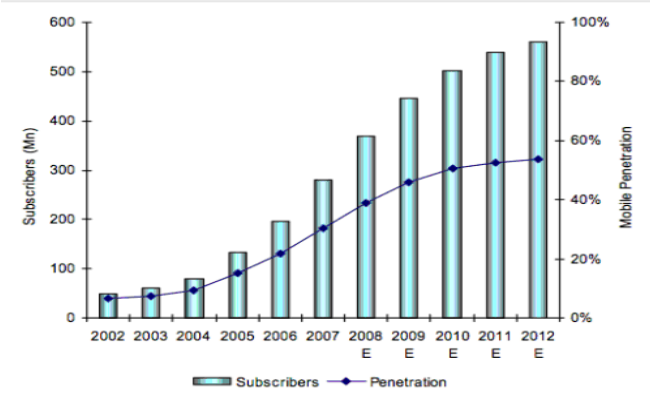
World Regions	Population (2008 Est.)	Internet Users Dec/31, 2000	Internet Usage, Latest Data	% Population Penetration	Usage % of World	Usage Growth 2000-2008
Africa	955,206,348	4,514,400	51,065,630	5.3 %	3.5%	1,031.2 %
Asia	3,776,181,949	114,304,000	578,538,257	15.3%	39.5%	406.1 %
Europe	800,401,065	105,096,093	384,633,765	48.1%	26.3%	266.0 %
Middle East	197,090,443	3,284,800	41,939,200	21.3%	2.9%	1,176.8 %
North America	337,167,248	108,096,800	248,241,969	73.6%	17.0%	129.6 %
Latin America/Caribbean	576,091,673	18,068,919	139,009,209	24.1%	9.5%	669.3 %
Oceania/Australia	33,981,562	7,620,480	20,204,331	59.5%	1.4%	165.1 %
World Total	6,676,120,288	360,985,492	1,463,632,361	21.9%	100.0	305.5 %

Source: Internet Word Statistics 2008

market in the world with mobile penetration in the region ranging from 100% to 30%

- Pre-paid subscriptions account for nearly 95 percent of total mobile subscriptions in the region
- Most of the mobile operators are home-grown. In 2005, the continent's seven largest investors controlled 53% of the African mobile market
- Across most of Africa, SMS is likely to be the only non-voice value-added service to gain mass market popularity in the immediate future
- East Africans pay taxes of between 25% and 30% on mobile phone services, compared with an average of 17% across Africa
- African states with less than 600,000 subscribers and includes Burundi, Cape Verde, Central African Republic, Comoros (Union of the), Djibouti, Equitorial Guinea, Eritrea, Gambia (The), Lesotho, Liberia, Mayotte, Sao Tome and Principe, Seychelles, Somalia, Swaziland and Rwanda.

Fig. 5: Africa- Mobile Subscribers and Penetration (2002-2012)



Sources: African Telecom News

Figure 5 shows the subscriber number and penetration rates. This indicates that at the end of 2007 there were 280.7 million mobile phone subscribers in Africa, representing a penetration rate of 30.4%. The chart below shows the historical numbers up until 2007, with projected growth and penetration rates through 2012 (African Telecom News, 2008).

By pointing out more interesting facts, African Telecom News look at the major African markets to show case the huge growth potential for areas that are already very profitable. As can be seen Nigeria, Kenya and Egypt have the greatest growth potential.

RURAL DWELLERS AND CONNECTIVITY BY 2030

As earlier mentioned more than 2.5 billion people over 40% of the planet's population; live in rural and remote areas of developing countries. Of the small fraction that has any access to telecommunications, radio broadcast and voice telephony have traditionally been the main services provided. Today, a wide variety of new services such as e-mail, e-commerce, tele-education, tele-health/tele-medicine, among others, has made access to interactive multimedia services as important for rural and remote communities as voice connectivity alone. Since each district or community requires a different mix of voice text, image, video and audio communications to best meet its needs. What will the connectivity be like for these rural dwellers by 2030? what connectivity services and bandwidth services are expected to be seen in these countries by 2030. For those who care about gaps, the technology gap will grow. Many individuals and organizations in developing countries will operate on a hierarchy of wants, while the underserved world will operate on a hierarchy of more basic needs. ICT products will be sold as "lifestyle" choices.

In Malaysia for example a country with multiple industry players, the future growth of Malaysia's ICT network is predicted to take a number of different directions over the next few years. Nevertheless, given the abundance of backbone infrastructure all players in the market are expected to focus largely on expanding and upgrading their network at the local level, with a view towards accommodating the delivery of high-speed Internet services (ITU, 2004).

Africa is the fastest-growing mobile market in the world, having leaped from 16 million mobile subscribers in 2000 to 198 million in 2006. This strong growth is expected to continue, with a projected 278 million subscribers in 2007 (ITU, 2007). Multiple growth is still expected by the year 2030.

CONSTRAINTS

It is not an understatement to say that connectivity in the developing world is improving. However, this improvement is being inhibited by some constraints. Such constraints will be the subject of discussion under this sub-heading. Some of the constraints that will be discussed include but not limited to:

Rural teledensity in developing countries is still very low. Scarcity of communications infrastructure in such areas is exacerbated as a result of limited electricity, few fixed-line telephones, and low income levels (Sinha, 2005). That being the case, half of the world's population (3 billion people) lives in rural areas, with substantial overlap between rural dwelling and poverty (Coyle, 2005). Examining country data reveals a global digital divide (Bridges.org 2001, Rice and Katz 2003) and indicates that the emerging knowledge-based economy will reinforce the gap between rich and poor nations, and increase income and spatial inequalities within countries (Baliamoune 2002). This growing level of inequity necessitates a communication tool and subsequent ownership and payment model that acknowledge this challenge and seek to overcome it (Samaan, 2003). However, not all ICTs can be leveraged equally by the "have-nots" (Baliamoune 2002).

The speed with which the connectivity can be implemented will depend on available resources and access to electricity and ICT infrastructure. Predictably, implementation will proceed more slowly in rural areas.

The lack of infrastructure and supply of reliable electricity seriously constrains the adoption of ICT in rural areas. Further, the cost of

bandwidth is a universal constraint to Internet use. Comparatively few people have the skills to make good use of ICTs. Even people who receive such training are often unable to use their skills because of the lack of access to infrastructure.

The inadequacy of resources is a serious constraint that may hinder the planned introduction of universal access. Implementation of many of the initiative will depend significantly on donor support. Currently, there is limited available relevant and linguistically appropriate content.

Sustainability is another constraint. People have seen so many projects failed because they could not be sustained beyond the pilot phase.

GOOD PRACTICES

According to BEEP project (Best e-Europe practice), a good practices is the "the use of a method, tool, technology, etc. which is generally regarded as practices which are good for learning, i.e. practices which either environment, or (and more importantly) provide useful learning experiences which are likely to stimulate creativity, ingenuity and self reflexivity on the part of the user (BEEP.Org, 2003). The good practices in the sense of the subject of this paper, centers on the various initiatives that have been put in place in the developing worlds to improve ICT connectivity. Most of these have been discussed in the earlier section of this paper. They include the establishment of telecentres, community Internet/cybercafé, community library/reading centre and others practices aimed at learning periods, including: school and higher education, adult training (job seekers or professional world); practices aiming to change the professional world in term of arrangement of working hours, staff management and network inside or outside companies; practices aimed at personal life, familiarization with home computing, Internet use in the rural areas, etc.

PRACTICAL TIPS FOR SUSTAINABLE SOLUTIONS FOR GLOBAL DEVELOPMENT

Let it be enhancing the future ICT connectivity in the developing world is sine-qua-non to sustainable global development. To achieve this, governments and other stakeholders need to design and implement effective ICT strategies, the new technologies and services may help to reduce the gap for some disadvantaged or marginalized people. Whatever strategies put in place, there is need to focus on capabilities for using ICTs in ways relevant to development priorities. The developing nations should consider putting the following in place:

- Wireless access systems such as FWA (Fixed Wireless Access) and VSAT are effective means of establishing infrastructure in rural areas since they are less costly and easier for installation over the wired systems; IP(Internet Protocol) based network is more economical and flexible than circuit switched network;
- Routers. These may be designed to deliver wide range of traffic types more efficiently than traditional wired and cellular telephony network;
- Shared use concept is useful for making ICT terminals and facilities at Multipurpose Community Tele-centers available at affordable cost for rural users;
- The financing scheme and/or special funding mechanism for the start-up of the rural and remote area services may be useful for the accelerated improvement of the rural and remote accessibility;
- Collaboration for promotion of rural projects among multi-actors such as Governments, UN

Agencies, PTOs and NGOs etc. should be encouraged.

- Participation of women and the youth for the promotion of information access for rural community should also be encouraged.
- Improve Infrastructure on a global basis using an affordable, maintainable structure
- Explore building accessible electronic and information technology features for services offered by Internet Service Providers
- Recognition of the right to access information regardless of disability, economic situation or geographic location.
- Raise Awareness of Accessibility Issues throughout the world with outreach and education.
- Encourage organizations working for the validation, management, and distribution of speech, text, and terminology resources and tools, and to promote their use within the global telematics RTD (research and technological development) community.

In countries where favorable forms of deregulation are incipient, it is recommended that governments make every effort to develop more access to health, education and government services by means of public access points in the information infrastructure at low or no cost, with clearly defined rules. The rapid rise and evolving compatibility of cellular and other mobile communications gives governments and companies extraordinary opportunity to encourage the development of wireless devices with full Internet access in order to provide immediate enhanced access to the Net for mobile users. Tenders and auctions for promoting wireless devices should be considered urgent. So should be the development of content designed for access through these devices and oriented to education and training or their support and continuation in the workplace. Accessibility rises only in the context of a political and cultural evolution, which promotes respect among people, enlightens and sensitizes people to the critical problems of others and creates new job opportunities for the emerging new economies.

Furthermore, IDRC (2008) points out that special attention needs to be given to providing the least-developed countries, especially in sub-Saharan Africa, and the rural areas of lower-income countries with the financial resources, physical infrastructure, and knowledge base to achieve sustainable-development goals. IDRC explained further that innovative knowledge-based development strategies based on new models of governance and market development are being formulated. When ICT strategies and policies are in place, a limited investment in human and technological capabilities can have an enduring, catalytic effect on development concerns, including poverty, gender inequalities, and the environment. Special attention also needs to be given to modifying the technologies and applications to support these priorities.

IDRC (2008) also suggests that significant barriers will need to be overcome if the population in the least-developed countries is to realize the full benefits of ICTs by 2050. As new ICTs are developed, the need to put ICT strategies in place will become even more pressing. Although there is a risk that further diffusion and use of ICTs will exclude some people, coherent ICT strategies need to be developed to unleash the unrealized potential of these revolutionary technologies for the future prosperity of developing countries.

CONCLUSION

Going by the trends of connectivity in term of services and initiatives being put in place, it is assumed that the future of ICT connectivity in the rural areas of developing world looks promising. If developing world can consider putting in place some of the tips above, and borrowed other initiatives from the developed world and at the

same time if the governments of the developing world can co-operate with the technology company in their individual country; all things be equal, these will take them to places. Not this alone, it will also guarantee their sustainable development by the year 2050.

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