Role of Information and Communications Technology (ICT) in Achieving Sustainable Development in Nigeria: Challenges and Prospects.

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Abstract. Information and communication technology (ICT) in developing countries is suggested as an effective way to improve the population's life and well-being of the citizens. In particular, ICT applications on the education system might change the future of the under developed nations like Nigeria, fundamentally through the connections to 'the flat world'. However, there are some challenges and prospects which the developing world faces when they adopt ICT in the education sector. These challenges are limitations on cost, internet access, trained staff and adequate policy. This report focuses on these hurdles and their corresponding solutions to the implication of ICT in achieving sustainable development in Nigeria.Some criticism and considerations are also presented.

Keywords: Role, ICT, sustainable development, challenges, prospects.

1 INTRODUCTION

Over the past few years, several countries have documented the successful implication of ICT in schools (Lim & Hang, 2003, adapted from Mann, Shakeshaft, Becker &Kottkamp, 1999; Sivin-Kachala, 1998; Wenglinsky, 1998). These paper studies have shown that ICT facilitates the acquisition of higher order thinking skills by providing cognitive scaffoldings for students as they make sense of the information gathered; allowing experts, teachers and students to communicate their thoughts and interests in subject matters and simulating real-life situations and problems for students as they explore the connections between concepts and ideas.

21st century children choose to look for answers to their questions on the internet (Myungnghee Kang et al., 2011). Also, students who had followed ICT courses had more possibilities of being employed as most of the jobs nowadays require a good knowledge of ICT.

Research studies have shown that the use of ICT as well as other teaching strategies have enabled students to move to higher-order thinking (Jonassen& Carr, 2000; Kearney &Treagust, 2001; Oliver &Hannafin, 2000). Thus, students develop constructive thinking skills. As a result the students are learning in order to prepare themselves for the future information age.(Salomon, 1993). According toKozma (2005) ICT can be used to enhance students understanding thus increasing the quality of Education.

In addition, Papert (1997) noted the advantages of ICT for students and they may be as such: the students are more motivated and as such they become more creative when they are faced with new learning environments. Also, they are prone to assimilate in a disciplined way working collaboratively with their peers. As a result, they are able to generate knowledge. They will have the capacity to handle rapid change in any type of environment.

ICTs stand for information and communication technologies and are defined, for the purposes, as a "diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information." These technologies include computers, the Internet, broad casting technologies (radio and television), and telephony.

2 LITERATURE REVIEW

According to Pelgrum and Law (2003) in the early 1980s, the term 'computers' was replaced by 'IT' (Information Technology) which means a shift from computing technology to the capacity to store and retrieve information. Hence, the term 'ICT' (information and communication technology) was brought forward around 1992 (Pelgrum, W.J., Law, N., 2003).

Another definition had it that ICTs include the networks and services which affect the local and global accumulation and flows of public and private knowledge (Adeya, N.C., 2002). In addition, Adeya (2002) came forward with a simplified definition describing ICTs as an 'electronic means of capturing, processing, storing and disseminating information'.

The term ICTs involves multimedia, the Internet or the Web, as a medium to enhance instruction or as a replacement for other media (Pelgrum, W.J. Law, N., 2003).

2.1 The Effectiveness of ICTs in Education

ICTs are potentially powerful tool for extending educational opportunities, both formal and non-formal, to previously underserved constituencies—scattered and rural populations, groups traditionally excluded from education due to cultural or social reasons such as ethnic minorities, girls and women, persons with disabilities, and the elderly, as well as all others who for reasons of cost or because of time constraints are unable to enrol on campus. The effectiveness of ICT are listed and discussed as follows:

- Anytime, anywhere. One defining feature of ICTs is their ability to transcend time and space. ICTs make possible asynchronous learning, or learning characterized by a time lag between the delivery of instruction and its reception by learners. Online course materials, for example, may be accessed 24 hours a day, seven days a week. ICT-based educational delivery (e.g., educational programming broadcast over radio or television) also dispenses with the need for all learners and the instructor to be in one physical location. Additionally, certain types of ICTs, such as teleconferencing technologies, enable instruction to be received simultaneously by multiple, geographically dispersed learners (i.e., synchronous learning).
- Access to remote learning resources. Teachers and learners no longer have to rely solely on printed books and other materials in physical media housed in libraries (and available in limited quantities) for their educational needs. With the Internet and the World Wide Web, a wealth of learning materials in almost every subject and in a variety of media can now be accessed from anywhere at anytime of the day and by an unlimited number of people. This is particularly significant for many schools in developing countries, and even some in under developed countries, that have limited and outdated library resources. ICTs also facilitate access to resource persons, mentors, experts, researchers, professionals, business leaders, and peers—all over the world.
- *ICTs help prepare individuals for the workplace*. One of the most commonly cited reasons for using ICTs in the classroom has been to better prepare the current generation of students for a workplace where ICTs, particularly computers, the Internet and related technologies, are becoming more and more ubiquitous. Technological literacy, or the ability to use ICTs effectively and efficiently, is thus seen as representing a competitive edge in an increasingly globalizing job market.

2.2 Uses of ICT in education

ICTs can enhance the quality of education in several ways: by increasing learner motivation and engagement by facilitating the acquisition of basic skills, and by enhancing teacher training. ICTs are also transformational tools which, when used appropriately, can promote the shift to a learner-centered environment.

- Motivating to learn. ICTs such as videos, television and multimedia computer software that combine text, sound, and colorful, moving images can be used to provide challenging and authentic content that will engage the student in the learning process. Interactive radio likewise makes use of sound effects, songs, dramatizations, comic skits, and other performance conventions to compel the students to listen and become involved in the lessons being delivered. More so than any other type of ICT, networked computers with Internet connectivity can increase learner motivation as it combines the media richness and interactivity of other ICTs with the opportunity to connect with real people and to participate in real world events.
- Facilitating the acquisition of basic skills. The transmission of basic skills and concepts that are the foundation of higher order thinking skills and creativity can be facilitated by ICTs through drill and practice. Educational television programs such as <u>Work it out</u> use repetition and reinforcement to teach the alphabet, numbers, colors, shapes and other basic concepts. Most of the early uses of computers were for computer-based learning (also called computer-assisted instruction) that focused on mastery of skills and content through repetition and reinforcement.
- Enhancing teacher training. ICTs have also been used to improve access to and the quality of teacher training. Teachers' knowledge in ICT brings educational reformation by helping teachers to do research in any course or topic they want to teach. It makes the teacher to knowthe newest development on the topic assigned and also gives more detail on the topic for example e-library. ICT makes teachers to know what is happening in the world at large like the issue of Ebola disease, Nigeria Union of Teachers(NUT) in collaboration with Federal Government educate teachers on what to do to eradicate this sickness in schools.
- **Finding out.** Students can use ICT to find out information and to gain new knowledge in several ways. They may find information on the Internet or by using an ICT-based encyclopedia such as Microsoft Encarta. They may find information by extracting it from a document prepared by the teacher and made available to them via ICT, such as document created using Microsoft Word or a Microsoft PowerPoint slideshow. They may find out information by communicating with people elsewhere using email, such as students in a different school or even in a different country.
- **Processing knowledge.** Students can use ICT as part of a creative process where they have to consider more carefully the information which they have about a given subject. They may need to carry out calculations (eg. by using Microsoft Excel), or to check grammar and spelling in a piece of writing (perhaps using Microsoft Word), or they may need to re-sequence a series of events (for example by re-ordering a series of Microsoft PowerPoint slides).
- Sharing knowledge.Students can use ICT to present their work in a highly professional format. They can create documents and slideshows to demonstrate what they have learned, and then share this with other students, with their teacher, and even via email with people all around the world.

2.3 Problems / Challenges facing ICT

Power Challenges. Lack of consistent and affordable electricity is the single greatest challenge in designing a computing infrastructure for rural health informatics (or any other application for that matter). The vast majority of health facilities in remote parts of the developing world have no mains power and, where available, such power is usually extremely unreliable or so unstable that it poses a threat to unprotected electronic equipment.

Among off-grid health facilities that nevertheless have power, diesel generators are the most common source. But increasing fuel costs and on-going maintenance problems mean that generators are seldom run for more than a few hours a day (often only during medical procedures that require powered equipment) and are prone to abrupt and unannounced failure. Alternatives such as solar panels are simply cost prohibitive when deployed to support standard computing hardware.

Pending the decade's long process of extending stable, grid power to remote communities or the advent of an entirely new computing paradigm, the logical immediate answer to this challenge lies in low-power-consuming hardware. Fortunately, hardware now exists that is cost-effective to run on solar (or other renewable) or in partial-grid power.

Environmental Challenges. The physical environment in most rural and remote settings is characterized by some combination of heat, dust and humidity, each of which is a challenge for standard computers. High speed CPUs generate enormous amounts of heat that, if not properly dissipated, reduces performance or can render these systems inoperable. Dust threatens sensitive electronics by shorting circuits and impeding airflow and heat dissipation. Humidity leads to condensation, corrosion and even mold, all of which can cause electrical problems and possibly shorten equipment lifespan.

Besides reducing power costs, power-efficient computing also helps to resolve these environmental challenges. CPUs with slower clock speeds generate less heat and, with appropriate thermal design, can be deployed without fans. This allows computer enclosures to be better sealed against these threats as well as vermin of various sorts. Fewer moving parts also means greater reliability and lower overall operating costs. In exceptionally remote and/or hot environments, solid-state flash memory can be substituted for hard drives, which are prone to failure in extreme heat and are a common failure point requiring support.

Connectivity Challenges. Lack of affordable connectivity and bandwidth is the primary obstacle to several of the most promising health applications for rural areas, including telemedicine and other real-time diagnostic support and training initiatives. Lack of connectivity also complicates more basic efforts to collect and analyse health information.

For example, managing electronic medical records for peripatetic patients requires some means of accessing patient information from multiple locations. Similarly, accurate and timely health statistics are extremely difficult to compile in the absence of some form of connectivity, as is managing logistics or other key processes. Finally, lack of reliable connectivity complicates core IT functions, such as systems updates and virus control, thus increasing costs while reducing use value.

Once again, however, tools now exist to overcome these challenges for a growing portion of the communities in questions. The dramatic expansion of cellular networks across Nigeria means that affordable data services are now available for the first time in many areas. Although most cell networks do not yet provide high-speed connectivity (at least not in rural areas), they can support a number of valuable asynchronous and low-bandwidth applications, like email, which are easy to use, powerful and sustainable. As these networks expand and are Upgraded, they will provide crucial connectivity for a large number of rural communities and will be better able to support data-intensive applications. Open protocols, such as WIFI, and durable off-the-shelf products offer an alternative, often complementary, approach. Work done at some Internet Service providers like MTN, GLO, Etisalate.t.c has adapted the core protocols for WIFI to allow increased bandwidth over long distances.

The technology relies on line-of-site, but for less than N5000 it is now quite simple to create a reliable broadband (6mbps) link over distances as great as 100-200km. Such links can be used to extend low cost Internet connections in urban settings to the near periphery at low cost or to share a VSAT connection to multiple facilities in more remote settings.

Even in the absence of Internet service, this approach can support high-speed networking among health facilities to deliver access to shared resources, tele-medicine, tele-training, VOIP telephony or other applications that require higher bandwidth.

Still, while connectivity options are improving, careful design for low-bandwidth and delay tolerance remain critically important. Only systems-level design that accounts for system resource as well as networking constraints can support this objective.

Human Resources and Other Non-technical Challenges. As important as these physical and infrastructural challenges are the many human factor and institutional obstacles to sustainable health information solutions in underserved areas. A partial list of these includes:

- Inexperienced computer users
- Lack of trained technical support
- Absence of defined, action-oriented health indicators
- Uncoordinated or absent governance mechanisms
- Inadequate oversight and/or incentives for health workers
- Widespread poverty and associated security risks

It's worth noting that to succeed health information solutions for rural and remote environments must accommodate inexperienced computer users and novice administrators, not vice versa. This is true both for usability and resiliency. In settings where users may be encountering a mouse and keyboard for the first time, an intuitive and simple interface are critical – "less is more."

Even when users are more sophisticated, lack of qualified on-site (or even in-district) technical support means that systems must be "hardened" against not just the physical environment but against user error as well.

One way to do this is to "lock down" the file system of the computers so that users cannot inadvertently delete system files or install viruses or other malware. If the system does somehow become mis-configured or infected, a simple on-off cycle will return the machine to its originally configured state.

Server software can include similar controls that streamline and simplify the process of configuring and managing workstations and system resources connected to a local or wide area network.

2.4 Progress and prospects

Despite these conditions, optimism for the realization of Nigerian ICT and higher education goals remain; especially following China's launch of a communication satellite for Nigeria. This is the first for an African country and the first time China has provided both the satellite and the launch service. The Nigerian Communication Satellite (NIGCOMSAT – 1) is a super hybrid, geostationary satellite that will provide communication services for Africa, and parts of the Middle East and Southern Europe. Experts have predicted that the satellite will

revolutionize telecommunications, create professional IT jobs and provide Internet access in remote villages. It is also expected to improve e-commerce and government efficiency by promoting the development of a digital economy in Nigeria and the rest of the African continent (Ololube, Ubogu & Egbezor, 2007). China's efforts represent a progressive move towards bridging the global digital divide, as there is no doubt that faculty and students in Nigeria would have much broader resources available to them were they to secure reliable access to the Internet.

Progress has also been made in terms of improving ICT penetration in university education in Nigeria. A 2009 survey of the online presence of 70 higher education institutions found that 46 Nigerian universities have an online presence whereas 24 are not online. The University of Jos, for example, has an online library (eGranary) and select infrastructure on campus to support basic forms of ICT integration in education. Some of the other university websites have online-learning portals with downloadable tutorials and provisions for online chatting; however, none support virtual classrooms, tele-conferencing and other synchronous forms of online-learning. Government departments, non-governmental organizations, financial institutions and individuals are all beginning to understand the need for these types of learning tools and have begun to fund ICT implementation in Nigerian educational institutions. Some of these organizations include the Nigerian Communications Commission (NCC) and Education Trust Funds (ETF) (Iloanusi&Osuagwu, 2009). Strategic plans and related projects that regularly revisit Nigerian ICT targets are ongoing.

The prospects for the use of ICT in teaching and learning in Nigerian higher education are positive, though there is much work left to be done. Aduwa-Ogiegbaen and Iyamu (2005) have observed that ICT enhances educational efficiency in general and that the efficiency of faculty teaching in Nigerian institutions stands to be improved. Many higher education faculty, for instance, are already teaching large classes of students using ICT materials. With enhanced ICT capabilities it would be possible to use carefully prepared ICT programs to ensure that learners are more accurately and systematically instructed using effective instructional technology.

3 CONCLUSION

The role of ICT in developing countries is significant and critical for their rapid economic success which might lead to closing the gap between the developed and developing world. When implementing the ICT in the education sector, there are considerable challenges such as cost, internet access, training and policy issue. But, each issue has its own ways of addressing which is effective practice around world. However, all these changes for development through applying ICT to the education sector must consider the environment each country faces, because the situation of each nation is totally different from each other. It might be different from region to region within the country and it changes as time goes by.

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