THE ROLE OF ICTs TO ACHIEVING THE MDGs IN EDUCATION:
An Analysis of the Case of African Countries

by

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References
1.0 Objectives of the Paper

The objective of this paper is to carry-out an analysis of the key challenges and the uses of information and communications technologies (ICTs) towards the achievement of the Millennium Development Goals (MDGs) in African countries with a specific focus on education. The paper is however not about evaluating the performance and the progress made by African countries towards the realization of the set targets of the MDGs but rather on examining a possible link between the deployment and exploitation of ICTs within the economy and society of these countries and the achievement of the MDGs in education.

In an attempt to establish this link, it is also worth pointing out that the paper does not aim to establish proven empirical links between ICTs and the achievement of the MDGs, but rather to illustrate the possible impact that ICTs can make as an enabling tool for socio-economic development and by so doing directly or indirectly impact on the achievement of the MDGs as they relate to the area of education.

2.0 Exploring the Landscape of Educational Delivery Technologies

The unprecedented rapid growth in ICTs including the global communications technologies facilitated by the emerging sophisticated globally-based electronic messaging and networking technologies as seen in the last two decades is revolutionizing the way we live, work and learn. These emerging technologies are rapidly removing the traditional barriers of time and distance that until now hinders the transfer of information, skill and expertise from one place to another [1]. For example, ICT-enabled educational delivery technologies made possible by the advances in these technologies is rapidly becoming a growth area world-wide.

These emerging computer-mediated communications and multimedia educational technologies are making high quality educational programs easier to design, develop and deliver than was possible before. With these modern technologies, it is now possible that, irrespective of location, students can use these technologies to access educational resources from anywhere in the world.

There is no doubt that the relevance of ICTs for supporting education and training at all levels of the educational system has acquired new dimensions and greater urgency in a number of countries including those of Africa. The introduction of ICTs to support teaching, learning and administration of the educational delivery processes and systems is fundamentally changing the educational delivery and support landscape in a number of countries in both the developed and developing world.

In particular, advances in educational delivery technologies are making a major impact on the development, provision and delivery of educational and training programs at all levels of the
educational system in most countries of the world including those of Africa. There is no doubt that ICTs are making it possible to improve access to limited educational resources to a larger population. It is now possible through the use of these emerging technologies to provide high quality education at an affordable cost to a wider population in these countries.

The important role of technology for supporting modern education and training in one form or another cannot therefore be over-emphasized. In fact, more and more attention is being given to technological issues and how these relate to the question of the design, development, delivery and distribution of educational programs both for distance education and campus-based systems. For example, the explosive growth in network technologies and products and the rapid spread of the Internet, as well as the advances in multimedia and collaborative software environment is fueling a new wave of better teaching, training and learning tools.

This generation of educational delivery technologies promised more than just an improvement in educational productivity. They may deliver a qualitative change in the nature of learning itself. These emerging educational technologies are providing developing African countries with new ways of education, training and learning.

According to [2], educational delivery technologies and platforms can be defined to include both the various types of delivery media and the delivery/transmission systems, mechanisms or platforms for facilitating the teaching and learning process within either a face-to-face campus-based environment or a distance education and learning environment.

The delivery or transmission system or platform on the other hand include: POTS (plain old telephone systems), computer-mediated multimedia systems (CMMS), multi-channeled direct digital broadcasting satellite (DDBS) systems, interactive computer-mediated multimedia conferencing (CMMCS) systems and other systems based on advanced telecommunication and communications technologies to support high speed voice and data transmission and multi-media applications.

Others include: radio and TV broadcast technologies (one-way and two-way interactive systems); Internet-based technologies and resources, wireless and satellite-based data/voice transmission and broadcast technologies including those based on geostationary (GEO) satellites, medium-earth orbiting (MEO) and low-earth orbiting (LEO) satellite and VSAT technologies as well as other networking tools like video-conferencing among others.

Also to be included in the list of educational technologies is the multimedia presentation technologies, explosion of which in the last couple of years has transformed the landscape of the provision of education and training in a number of countries world-wide. For example, more and more educational institutions, including the schools are using multimedia presentation technologies for educational delivery and the use of Web-enabled multimedia courseware to support teaching and learning is rapidly transforming the landscape of educational delivery at all
levels of the educational system in a number of countries. We present in Fig. 1 below a topology showing the various types of technologies that could be used to support the delivery of educational resources and services at the various levels of the educational system in both the rural and urban areas in most African countries.

It is possible to have a combination of these technologies and delivery platforms serving as an integrated communications network for supporting one or more educational delivery systems. For example, we could have an Internet based educational delivery system based on a wireless network (e.g. VSAT system) for providing a short-haul link and a satellite link providing a long-haul connectivity to the Internet backbone.
3.0 A n Overview of the ICTs-for-Education Policy Initiatives in African Countries

The key role that ICTs can play in widening access to education to a wider section of the population of African countries; and for supporting literacy education and for facilitating educational delivery and training at all levels has been acknowledged by the majority of African Governments. A number of these Governments are committed within the context of their national ICT for Development (ICT4D) programs to facilitating the deployment ICTs at all levels of their educational system.

Most of these African countries identified the education sector as a priority area for the deployment and the exploitation of ICTs to broaden access to education, improve quality of educational delivery and to promote efficiency in the administration of the educational system as one way of reducing cost of education delivery.

Taking the case of Ghana as an illustration [3], the Government sees the deployment of ICTs within the educational system as a means for facilitating the transformation of the educational system to provide the requisite educational, and training services and environment capable of producing the right types of skills and human resources required for developing and driving Ghana’s information and knowledge-based economy and society. To this effect the Government is committed to a comprehensive programme of rapid deployment, utilization and exploitation of ICTs within the educational system from primary school upwards. This policy commitment translates into:

- directing efforts at using ICTs to facilitate education and learning within the educational system and to promote e-learning and e-education as well as life-long learning within the population at large; and

- putting in place policy measures to strengthen science education at all levels of the educational system and as well as promote technical and vocational training with emphasis on the use of ICTs to facilitate the training and learning process.

The emphasis at the level of the schools is on supporting teaching and learning activities and as well as supporting the administrative activities within the schools and as well as promoting the integrating the use of the ICTs within the teaching and learning activities of the school.
**Box 1: The Namibia ICTs-in-Education Program**

Namibia embarked on its ICT-in-Education program in the late 1990s targeting the introduction of ICTs within all levels of the educational system. The Government stated its policy goal in this area as: to produce ICT literate citizens; produce people capable of working and participating in the new information and knowledge based economy and society; to leverage ICTs to assist and facilitate learning for the benefit of all learners and teachers across the curriculum; to improve the efficiency of educational administration and management at every level of the educational system; to broaden access to quality educational services for learners at all levels of the education system; and to set specific criteria and targets to help classify and categorize the different development levels of using ICT in education.

**Box 2: Promoting ICT for Education in Algeria**

According to [4], Algeria has placed considerable emphasis on the importance of developing a national ICT strategy for education and training. The Ministry of Education has taken steps to support the implementation of the strategy either by direct action or through the various institutions and agencies that partners with the ministry, such as UNESCO, the EU, and different UN agencies. Within the framework of enhancing the level of ICT penetration and usage in education, the Government of Algeria signed a number of agreements with international organizations. Algeria has adopted a number of initiatives aimed at improving the quality of teaching and learning. Some of these strategies targeted at:

- Promoting the development of e-learning resources
- Facilitating public-private partnerships to mobilize resources in order to support e-learning initiatives
- Promoting the development of integrated e-learning curriculum to support ICT in education
- Promoting distance education and virtual institutions, particularly in higher education and training
- Promoting the establishment of a national ICT centre of excellence
- Providing affordable infrastructure to facilitate dissemination of knowledge and skill through e-learning platforms
Box 3: The Gambian ICTs-in-Education Initiative

The Gambian ICTs-in-Education programme among other things is targeted at initiatives and projects aimed at: (i) implementing a number of national ICT applications relevant to the various levels of the Gambian educational system; (ii) implementing specific ICT programmes and initiatives targeted at improving the educational delivery system; (iii) computerization of the operations of the educational sector Ministries and their respective organs; (v) developing the necessary standards, curriculum, best practices and guidelines to guide and support the deployment, and the exploitation of ICTs in the schools, colleges and the universities; and (vi) providing the necessary institutional set-up to support ICT exploitation and development within the educational system, the ICT training provision sector and the research institutions. Some of the projects identified for implementation include those targeted at the:

- Development of the Gambian SchoolNet Educational Delivery Communications Network
- Computers-in-Schools Project
- Development of the National ICT Curriculum.
- Computer-Literate Teachers Competency Initiative
- Educational e-Content Development Initiative
- Implementation of an ICT-Enabled School Management and Administration System
- National Higher Education E-Learning, Distance Education and Open Learning Project

Box 4: Rwanda’s E-Education Initiatives

The Government of Rwanda as part of its internationally acclaimed ICT-led Socio-Economic Development Programme acknowledged the key role that ICTs can play in educational delivery and training and the need for ICT training and education in schools, colleges and universities. The Government further acknowledges, the role that ICTs can play in literacy education and need to improve the educational system as a whole.

The Government as part of its ICT Strategy to speed up the process of the deployment of ICTs in the society and economy to develop an IT literate nation and to support the development of human resources in ICTs and other key professional skill areas is: committed to the rapid deployment, utilization and exploitation of ICTs within the educational system from primary school upwards. Rwanda has for the past decade initiated the implementation a comprehensive programme for the deployment and exploitation of computers in schools, colleges and universities. Some of the initiatives being implemented nationally include:

- A Programme to promote the acquisition of computer equipment by the Educational Institutions
- A Computers in Schools -- “Operation ICT Knowledge for the Youth” Programme
- A National SchoolNet Project
- An Initiative to Develop a National Computer Curriculum for Primary Secondary
4.0 Promoting ICTs in Education in African Countries: Some Case Studies

We examine below a number of practical cases of the application of ICTs to support educational delivery in a number of African countries.

4.1 The Deployment of SchoolNets in African Countries

A major application area of the use of ICTs to support education at the level of the schools in a number of African countries is the implementation of SchoolNets. Countries like Egypt, Ghana, South Africa, Rwanda, Ethiopia, Senegal, Uganda, and a substantial number of other African countries have for a couple of years been experimenting with the SchoolNet concept using mainly the Internet and its resources as the development and delivery infrastructure. In each of these cases, the SchoolNet serves more or less as an ICT-mediated application development and delivery environment for the development and delivery of educational programs and other school-related materials targeted at schools at the pre-university level.

For example, a SchoolNet serving as educational program development and delivery environment can in principle be used to facilitate all levels of interactions and collaborations including: learner-teacher interaction, learner-teacher collaboration, learner-learner interaction, learner-learner collaboration, as well as teacher-teacher interaction and teacher-teacher collaboration.

We for example, have the case of the South African SchoolNet system where a number of learners from either the same school or different schools collaborate in the learning process using the facilities of the program delivery infrastructure and tools of the SchoolNet system to interact with each other.
A number of teachers/instructors in some of the African countries implementing SchoolNets are also using the facilities and resources of their SchoolNet to interact with each other to develop and deliver teaching materials via a collaborative cooperative effort. We also have situations where learners and teachers interact to facilitate a learning process within a framework of collaboration between the two parties.

Some of the African countries are also using the resources of their SchoolNet system to in a limited way: facilitate and aid the delivery and administration of school examinations; and to facilitate the sharing of information on various aspects of schools by pupils and teachers participating into the SchoolNet system.

Others are using the network resources and infrastructure of their SchoolNet system to disseminate information on: (i) inter-school activities like sport competitions, social meetings, teachers’ congresses and so on (ii) school syllabus and recommended text book lists for various subject areas, (iii) examination papers and results including those of annual school examinations and school leaving certificate examinations (iv) Ministry of Education (MOE) guidelines on various subject matters relating the running and administration of the schools (iv) data relating to the details of the pupils, teachers, the physical infrastructure, facilities and other resources, and the performance record (in sports, examination etc.) of schools within the SchoolNet system.

School pupil in a number of African countries like: Ghana, Ethiopia, Ghana, Rwanda, South Africa and many others are also using the SchoolNet as an access point to the Internet to access its wealth of resources help them in their student projects and assignments.

Despite this apparent growth in the implementation of SchoolNets in a number of African countries in the last two decades, it is however important to note that most of the SchoolNets in these countries, including those being implemented as part of the NEPAD E-schools initiative are in their infancy and as such are targeted at a limited number of activities. Key among these activities is the delivery of educational programs and for providing both teachers and pupils’ access to the Internet and its resources.

This limited scope of the existing SchoolNets -- most of which are being implemented as pilot projects could change as the SchoolNet concept gain in popularity and the delivery infrastructure and technologies like those of the Internet continue to improve and become more accessible and affordable to a greater number of the school population in a number of African countries.

In conclusion, there is no doubt that despite the challenges being faced by some of the African countries in rolling out their SchoolNet initiatives more and more of these countries are going to implement some form of the SchoolNet concept as a major application area of ICTs to support educational development and delivery at the level of the schools in the years to come. The implementation of SchoolNets in African countries could in the long-run impact on improving and widening access to education at the level of the schools and as such may influence the pace towards the achievement of the MDGs targeted at education in these countries.
4.2 ICTs-in-Education in Africa – Some Selected Case Studies

Beyond the use of ICTs as a key application area for supporting SchoolNet initiatives in African countries, we review below a number of case studies in the area of the use of these technologies to support education in these countries with a view to establish a possible role that the use of these technologies can play towards the achievement of the MDGs in the area of education.

**Access to Education and Training Resources:** As documented in the accompanying background paper - ‘An Analysis of the Role of ICTs to Achieving the MDGs-A Background Paper’, a number of the African countries including Rwanda, Ghana, Ethiopia, Nigeria, South Africa, Algeria, Tunisia and many others are implementing various forms of e-education programs and initiatives using ICTs to improve and widen access to educational resources in a number of ways including: improved access to learning materials and resources, widening of access to education through e-learning etc. A number of these initiatives are contributing to promoting universal primary education in a number of these countries.

Also a number of these countries are deploying ICTs to improve the effectiveness and efficiency of delivery of education at all level of the educational system especially at primary and secondary education level. Taking the case of Rwanda as an illustration of the rapid rate at each African countries are adopting ICTs to facilitate educational delivery in their schools, it is reported in [6] that in 2000 just one school in the country had a computer. Six years later over half of primary and secondary schools have been equipped with hardware, over 2,000 teachers have received ICT training, and all public schools are expected to be connected. The figure for 2005 shows that out of the 400 secondary schools that have been fully equipped, 39 of them have wireless Internet access. These efforts being taken by Rwanda as is the case in a number of African countries may in the long-run improve and widen access to education within the school system in these countries.

**Widening Access to Education and Reducing Physical and Social Barriers to Education:** Some African countries are using ICTs to create new avenues for access to schooling for the underserved communities and vulnerable groups. A number of these countries like: Egypt, South Africa, Kenya, Tanzania, Ethiopia and Ghana are also deploying ICTs to provide innovative educational delivery mechanisms and systems to support the provision of education, especially distance education and non-formal education. Ethiopia for example, through its SchoolNet project has equipped over 200 of its schools with computers and set up computer laboratories with connection to the Internet with a number of them facilitating access to educational resources and learning materials.
The deployment and the use of ICT-based educational delivery and support technologies and resources to complement the traditional mode of education as step towards reducing physical, geographical and social barriers to education can also be identified as one area in which these countries are using these technologies to support education delivery at various level of the educational system.

**Quality Teacher Training and Empowerment:** A number of African countries including, Rwanda, Ghana, Burkina Faso, Nigeria, Mali among others are using ICTs as a tool for training school teachers. These efforts can indirectly contribute to the promotion of universal access to education (an MDG) at the primary school levels and at other levels of the educational system in these countries. Some of these countries by extension are using these technologies to support on-the-job teacher training using open/distance learning (O/DL) education and training delivering modes and systems.

Others are also using these technologies train a critical mass of computer-literate teachers for the school system, while some are using the resources provided by the Internet to empower teachers to facilitate linkages with their counterparts locally, nationally and internationally to exchange experiences on best practices.

These efforts are no doubt contributing to providing improved and quality training to school teachers at the primary and secondary school levels to increase the supply of quality trained teachers for the school system. These in turn as should be expected do have some impact on the achievement of MDG goal aimed at promoting universal primary education in these countries.

**Box 5: ICTs-in-Education: The Botswana Case**

According to (4), Botswana has made a commendable effort to provide ICT resources for its junior secondary schools. The Government committed itself to rolling out computer laboratories in the majority of its schools.

All the government-equipped schools were reported to have over 20 computers with a server and a local area network. Computers are also available at education centres and are also being used to support education administration activities of the Ministry of Education. These are used for administrative and educational purposes. Most of the private schools in Botswana also have computer resources and are connected to the Internet to support education and learning activities.

**Modernization of the School System:** A number of African countries are using ICTs to modernize the operations and the teaching and learning environments of their schools. The integration of ICTs into the curriculum is one area that is contributing to the quality of primary school education in some of these countries.
Another area is the use of ICTs by some countries to improve the efficiency and effectiveness of educational delivery in the school system. The efforts can indirectly contribute to the quality of education delivery in these countries and hence impact on the achievement of the MDG – promoting universal primary education in these countries.

**Box 6: Egypt’s Multimedia Laboratories and Knowledge Sources Network**

According to [4], Egypt as part of its ICTs-in-Schools initiative has established Multimedia Laboratories in all public and experimental schools for the projection of multimedia programmes using computers as a teaching aid. TV and video sets, enlargement projectors, and interactive CD-ROMs and drivers have been provided for the kindergarten and primary stages.

Egypt has also established what it called a Knowledge Sources Network to support ICT-enabled educational delivery in its schools. This network connects twenty-seven “distance training halls” and 127 schools to the Internet and provides over 4,000 schools the use of e-mail services through the network of the Ministry of Education. A central “electronic library” has been set up with of CD-ROMs, videotapes, and books with teaching aids and all schools participating in the project benefit from the remote access to the central library. It has been reported that the Internet services are being expanded to reach 4 Mbps to enable a large number of sites and schools to exchange files and share screens by sound, text, and pictures.

**Improvements in the Educational Management and Institutional Set-up:** The Ministry of Education and the other school administration agencies in some of the African countries have benefited from the use of ICTs to improve the efficiency of their operations. The deployment of ICT systems to improve school administrative processes, procedures and operations are no doubt facilitating better management of school resources and operations to improve enrollment and educational delivery at all level of the educational system including the primary and secondary school levels. The indirect impacts on the promotion of universal primary education cannot be underestimated.
Box 7: Automation of Secondary School Placement and Online Exam Result Delivery, Kenya

This initiative is one of the finalist of the 2007 TIGA Awards instituted by the United Nations Economic Commission for Africa (UNECA), is a Government of Kenya (www.education.go.ke) initiative aimed at improving access to educational information and services through use of ICTs. The project has two key components: (i) Automation of the delivery of primary and secondary school examination results through posting the results on the Ministry of education website. The results database is also accessible on a web interface through an access control system to ensure only those authorized are able to access the system; and through SMS messaging. (ii) Automation of the selection and placement of secondary school admissions. The manual system being implemented earlier led to countless errors and malpractice especially in placement to the highly prestigious national public schools. As a result, many deserving candidates were unable to secure rightful placement in these schools despite excellent performance. [Source: UNECA, 2007 TIGA Awards, www.uneca.org]

Box 8: E-applications -Secondary school certificate, Educational Information Centre, Sudan

This initiative is one of the finalist of the 2009 TIGA Awards instituted by the United Nations Economic Commission for Africa (UNECA). It is a Sudanese Government initiative (http://www.moe.gov.sd). The project is aimed at the use of ICTs to facilitate the publication of secondary school examination results and for the preparation of certificates targeting a large number of users. It covers key aspects of the secondary school certificate examinations including serving as an online past exam questions bank for students. The project has been demonstrated as a practical operationally sustainable. [Source: UNECA, 2009 TIGA Awards, www.uneca.org]

4.3 The ‘ICT-in-Education’ Initiatives in African Countries: The Common Features

Most ‘ICTs-in-Schools’ initiatives in African countries are pilot initiatives – a number of which are not scalable. A number of these initiatives are donor-driven or supported – a number of which have sustainability problems after end of the project. Most African countries do face resource availability problems in implementing their ICT-in-Education’ initiatives.

Some of the countries are facing challenges in the areas of human resource capacity and in the area of ICT infrastructure development and deployment to support these initiatives. Some of the other deployment problems being experience include:
• **Weak communications and computer network infrastructure** - The educational institutions in the majority of African countries do not have the requisite computer network and communications infrastructure to support a critical mass of e-learning activities

• **Limited computer resources to support educational program delivery and administration** - The students to computer ratio in educational institutions in some of African countries can be as low as 1:20 or more. This no doubt is limiting the spread of the use of ICTs to support education in a number of these countries

• **Low-level of Internet access and limited bandwidth of access** - Although all African countries now have access to the Internet with access mainly concentrated in urban areas, in particular in the capital and big cities, most African educational institutions are still struggling with improving access and making the Internet affordable for their staff, teachers and students.

• **High Cost of Access**: Apart from problems of limited bandwidth and the unreliability of access, very few African schools and colleges provide free access to the Internet for their faculty and students. Without reasonably affordable access to the Internet and improvements in bandwidth and the spread of access, most Africa educational institutions will continue to struggle to introduce e-education and learning into their school and institutions of higher learning.

We examine in the next section a number of other key factors that could limit the ability of African countries to use ICTs to achieve the MDGs in the area of education.

### 5.0 The Use of ICTs Towards the Achievement of the MDGs in Education – Examining The Challenges

It could be argued that with increasing population and the widespread recognition of the value of education, most African countries are facing an increasing demand for their limited educational resources. The educational sector in most of these countries are in effect operating in what could be described as an education-resource impoverished environment, characterized by limited educational resources, in the face of increasing demands for educational services. In a number of these countries, the problem is more acute in the rural areas where the majority of the population resides. It could be argued that in the majority of the African countries most of the schools in the rural areas lack the basic educational resources.

Also in most of the African countries, limited public funding for education is a major constraints on the process of change and development in education in these countries. It is also a source of
the current crisis facing the educational sector especially in the rural areas in a number of these countries.

Most of the educational institutions at the primary, secondary and tertiary levels including in particular rural-based schools could therefore be described as operating in what could be described as an education-resource impoverish environment characterized by limited educational resources, in the face of increasing demands for educational services. These challenges could have implications on the achievement of the MDGs in the area of education.

It could therefore be argued that although the emerging educational delivery technologies are providing a number of African countries a window of opportunity to achieve their national educational goals and by so doing make some progress towards the achievement of the MDGs in education, a number of them are facing some specific challenges in the area of the deployment of these technologies. Some of the challenges include:

**Poor and Limited Communications Infrastructure:** Given the important role that ICTs are playing in the delivery of educational services, the poor state of the ICT infrastructure in most African countries is a major obstacle to expanding educational and training opportunities in a number of these countries.

Although the ICT landscape of a number of the African countries has in the last decade or two undergone major transformations which to some extent was facilitated by a number of institutional and regulatory initiatives including the liberalization of the communications sector to encourage competition, the telecommunication and communications infrastructure of some of these countries are still far from being developed. Most of the rural areas in some of these countries are to a large extent not served by the existing infrastructure.

Compare to other regions of the world, the majority of the Sub-Saharan African countries have on average comparatively low teledensity, and low teleaccessibility --- a measure of households access to telecommunication services. Despite the explosion of mobile phone services especially in the urban centers, --- the limited infrastructural capacities of the mobile networks have resulted into over-subscription and poor quality of service. Also investment in the telecommunication sector has been declining thus delaying infrastructural expansions in the sector and the slow deployment of value added advanced communication services and advanced technologies in a number of the African countries.

The development, expansion and the modernization of the nation’s communications infrastructure in the majority of African countries to achieve universal service and access to basic and value added telecommunications services to support educational development and delivery is
a key challenge facing these countries in their efforts to achieve their educational goals including making progress towards the achievement of the MDGs in education.

**Limited and Weak Internet Connectivity:** Africa still remains the continent with the least capability in ICTs and least served by telecommunication and other communications facilities. Poor ICT infrastructure, combined with weak policy and regulatory frameworks (as is the case in some of these countries) and limited resources, has led to inadequate access to affordable telephones, computers and Internet in a number of African countries.

Taking the case of the Internet as a crucial resource for the implementing e-education initiatives in African countries, it could be argued that despite the modest achievements in Internet connectivity in a number of African countries in the past decade, there are still a number of technological (infrastructural), and operational bottlenecks. One is the poor telecommunication infrastructure in some parts of these countries. The coverage of the Internet in a given country can only go as far as the telecommunications infrastructure extends. Some of the telecommunication bottlenecks in some of these countries are:

- the non-existence or the inadequacy of telecommunication infrastructure in some parts of these countries, especially in the non-urban areas.
- low-speed lines for connectivity to the Internet
- poor quality of connections, especially in the case of subscribers residing outside the cities
- narrow-bandwidth of links to the Internet for most of the educational institutions
- high Internet connectivity charges and usage cost being experience by the majority of the educational institutions in some of these countries
- high cost of ICT equipment and services

Other limiting factors to the growth and spread of the Internet to support education in some of the African countries include:

(i) **High Cost of Connectivity to Internet Backbones:** The high cost of the available long-haul link to the high-speed Internet backbones is one of the key obstacles to the use of the Internet for educational purposes in most of the Sub-Saharan African countries. As should be expected, this high long-haul connectivity cost usually translates into high subscription and connection charges to the educational institutions in these countries and as such raises the issue of service affordability and sustainability from the point of view of these institutions.

(ii) **High Cost to Subscribers:** Most schools especially the less-endowed ones in both the rural and urban areas most often cannot afford the running cost of access to the Internet to support education and training
(iii) Shortage of Technical Skills: One other key factor that is constraining the growth of the Internet in a number of African countries which in turn is having a negative impact on the use of these educational delivery technologies within the educational institutions is the acute shortage of technical staff to design, install, operate, troubleshoot, support and maintain these technologies in these institutions. For example, a number of ICTs-in-education initiatives and projects are seriously been constrained to the extent of being, delayed, postponed or poorly implemented technically simply because there are no enough technical expertise support the implementation of these initiatives.

Rural versus Urban Disparity in Infrastructure- A Key Challenge: Although a number of the major African cities have made some advances in expanding and modernizing their telecommunication infrastructure and Internet connectivity in the last decade; the continent’s rural areas where over 70% of the population live continue to be isolated under-served in terms of the ICT infrastructure. The largest cities and towns which account for about 12%-22% of the total population, have access to more than 75% of the total main telephone lines in most of the regions of the continent.

Excluding the Northern and Southern regions of Africa where there is a relatively more balanced distribution of the telecommunications infrastructure, the distribution in other regions of the continent is skewed towards the largest cities – urban centers. With more than 75% of Africa’s population living in rural areas, the huge disparity between the access of the urban and rural areas to basic services further compounds the magnitude of the digital divide in the continent.

Limited Technical E-Learning System Development Expertise and Know-how: There is lack of expertise in most African countries to develop, administer and deliver courseware and/or develop and maintain e-learning systems and networks. Although a reasonable proportion of the teachers in some of the schools in a number of African countries are becoming computer literate, the majority are yet to acquire the requisite expertise and know-how to develop and deliver ICT-based courseware and other instructional materials.

The majority of African educational institutions are yet to invest in the training of their teachers and staff in developing and delivery ICT-based teaching and learning materials. The majority of teachers although may be computer literate are yet to be trained to deliver their courses using ICT tools and resources.

Without adequate investment in the requisite expertise and know-how, most African schools, colleges and universities will not be able to harness the emerging educational technologies and systems to support teaching and learning.
**The Problem of Funding Conventional Education:** Most African countries do face problem in funding and meeting their educational budget. The educational system in a number of these countries are facing crisis – in the face of increasing demands for educational resources. A number of African countries are facing difficulty in supporting and funding their ‘traditional’ educational system (building new schools, buying text books, feeding school children, paying teacher's salary, training teachers). African Government to face difficulty in devoting some of their limited educational budget to the deployment of ICTs to support education in the face of difficulty in supporting their schools and universities.

**Lack of Standards and Guidelines to Support ICTs in Education:** There is lack of standards to facilitate ICT education in schools and to support the use of ICTs to facilitate educational delivery in schools and colleges in most African countries. Most Africa countries are yet to develop standards to support ICT education and training in their schools and in other educational institutions. Teachers using the technologies to support their teaching process are doing so in what can be described as ‘standard and guidelines’ vacuum. Most Ministry of Educations in African countries are yet to develop and deploy the requisite standards and guidelines for supporting teacher education and training in the areas of how best to use ICTs to support their work.

The need for standards and guidelines to facilitate and support ICT-in-Education initiatives in Africa cannot be over-emphasized. Some of the key areas that need to be considered include:

- standards and guidelines to facilitate teacher education in ICTs and the use of these technologies (including those of the Internet and other educational delivery technologies) to support the teaching and learning process in the schools;

- standards and guidelines to facilitate curriculum development to support ICT (computer) education in the schools and as well as support the use of computers to aid the learning process of students both at school and at home.

**Apathy and Resistance to Change:** There is apathy and resistance to change, as well as lack of motivation or incentive to change in relation to the introduction of ICTs to facilitate education in some of the educational institutions in African countries. Despite the increasing popularity of the Internet and other emerging educational technologies for supporting e-learning, a number of African educational institutions are still battling with resistant to change by their teachers, staff and students. In particular teachers and lecturers in educational and training institutions for various reasons (lack of incentive, motivation etc) are slow to embrace technology to support teaching and program delivery.

The bulk of the teachers and lecturers, still deliver their courses in the traditional mode using chalk and blackboard with just few venturing into using PowerPoint or other presentation tools to deliver courses. Assignments are still given on paper or blackboard without using the delivery
infrastructure of the Internet or the educational Intranet where it exists. Also course descriptions, schedules and handouts are still given to students in print format; student grades are still posted on campus notice boards rather than being sent to them electronically.

The resistance to change no doubt poses a major challenge to the roll-out of e-education programs in African educational institutions.

**Lack of Awareness in Respect to the Use of ICTs to Support Education:** Although ICTs are slowly permeating all aspects of social and economic life in a number of countries, there is still a large proportion of the population in African countries who are not aware of the opportunities that these technologies do offer to support all key sectors of the economy, including education. This lack of awareness especially in relation to the value of these technologies to support all aspects of education development and delivery at all levels of the educational system in African countries is one of the reasons for the slow take off and growth of the use of ICTs to support education.

**6.0 Concluding Remarks**

It has been established in this paper that ICTs can serve as an essential and powerful tool for supporting education in African countries. There is no doubt that, given the fact that most of the African countries are operating in an environment, characterized by limited educational resources, in the face of increasing demands for educational services, these technologies can play a key role in widening access to education to a wider section of the population, supporting literacy education; and facilitating educational delivery and training at all levels of the educational system in these countries.

There are some indications that ICTs can in effect play a role towards the achievement of the MDGs in the area of education. However, it is clear from the analysis carried out in this paper that, to make substantial and sustainable progress in this area, a number of the identified challenges need to be addressed by the various African Governments, their development partners and other stakeholders involved in promoting the use of ICTs to achieve education development and delivery goals including those of the MDGs.
References

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