

Use of ICT for Education, Research and Development in Ghana: Challenges, Opportunities and Potentials

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Abstract

This paper outlines the challenges, opportunities and the potentials in the use of Information and Communication Technology (ICT) in Ghana for Education, Research and Development. It presents several initiatives that have been made by the government of Ghana and other agencies to bridge the digital divide between Ghana and the developed world, with more emphasis on an ongoing Wide Area Network project called Research and Education Network (REN) aimed at networking all educational and research institutions in Ghana. Problems facing the continuing development of ICT in the country are identified and solution strategies to harness the full potential of ICT as an indispensable tool for the socio-economic development in Ghana are also discussed.

Introduction

ICT infrastructural development in Ghana is progressing at a rate (0.4% from 1995 to 2.9% in 2000) comparable to other low-income countries globally and above the 1.1% average for Sub Saharan Africa [1]. Over the years, several initiatives have been made by the government of Ghana and other agencies to develop the ICT-infrastructure so as to bridge the digital divide between Ghana and the developed world. Prominent among these initiatives is the development of a national fiber optic network (VOLTACOM) by the nations electricity provider, the Volta River Authority (VRA). There has also been massive investments in ICT infrastructure from existing Internet Service Providers (ISPs) and Telecommunication companies, such as the Ghana Telecom, Spacefon and Mobitel, whose activities cover the whole country. In addition, the government of Ghana and other agencies, including the Abdus Salam International Centre for Theoretical Physics (ICTP), has trained over a thousand professionals in ICT and related areas to provide the necessary knowledge and skills to support ICT activities in the country. Despite these massive investments in ICT infrastructure and ICT-capacity building, Ghana is still to a large extent digitally isolated from the Global Village because it lacks the critical drive and strategies to harness the full potential of ICT for the socio-economic development of the country. A motivational remark by one of the illustrious sons of Africa summarizes the need for ICT as a facilitator for socio-economic development and to bridge the digital divide:

"We paid the price of not taking part in the Industrial Revolution of the late eighteenth century because we did not have the opportunity to see what was taking place in Europe. Now we see that information and communication technology has become an indispensable tool. This time, we should not miss out on this technological revolution"
Professor F.K.A. Allotey, a distinguished Ghanaian scholar.

ICT Indicators in Ghana (1995-1998)

In 1995, Ghana became the first country in sub-Saharan Africa to have “full internet connectivity [3], yet ICT development is still in its infancy in Ghana. Telephone links to rural area are still very poor, despite recent advances in wireless telephony. As at 1998, the number of Internet host sites was 241 with about 4500 User, whilst 2.38 users per 10,000 inhabitants could be registered as users of the Internet. One detrimental factor is the high cost of Internet usage. The three main Internet Service Providers, AfricaOnline, Internet Ghana and Network Computer Systems charge between US\$35-US\$50 a month for dial-up services for an unlimited access. Corporate account for Internet access ranges from US\$50 for limited Access to US\$300 for unlimited access. Recently, there has been an increase in Internet Cafe’s and Communication Centres all over the country with the attended increase in the use of emails and related facilities. Table 1 summarizes the ICT indicators in Ghana from 1995 –1998 [2]:

Table 1: ICT indicators in Ghana (1995-1998)

INFRASTRUCTURE	1995	1996	1997	1998
Telephone lines	63,067	77,886	105,000	133,000
Teledensity	0.36	0.44	0.70	0.71
Digital main lines (%)	89.53	90.86	95.47	97.50
Waiting list for main lines	28,349	28,987	19,567	15,567
Public telephones	30	453	483	1814
Public telephones per 1,000 inhab.	0.001	0.02	0.03	0.11
Mobile subscribers	6,200	12,766	28,228	42,343
Mobile subscribers per 100 inhab.	0.04	0.07	0.16	0.24
Telecentres	30	76	96	176
Facsimiles	3,780	4,950	5,600	8,000
Computer(s) per 100 inhab.	0.12	0.14	0.16	0.30
ICT Human Resources	3,000	4,601	4,834	5,250
Radios per 100 inhab.	23.1	23.8	68.10	68.2
TVs per 100 inhab.	4.04	4.49	29.70	35.2
Cable TV subscribers	0	0	400	1000
Satellite dish subscribers	?	?	?	15,000
Internet host sites	6	203	241	253
Internet service providers (ISPs)	1	3	3	3
Internet users	300	2,500	4,500	7,500
Internet users per 10,000 inhab.	0.18	1.56	2.38	4.17
Internet bandwidth (Kbps)	9.6	256	512	640

ICT-Infrastructure for Education, Research and Development

The high subscription and infrastructure costs coupled with the poor quality of service by service providers as outlined in the previous section is a major hindrance to the use of ICT in education, research and development [3].

To create an enabling environment for the use of ICT, foster information exchange among local scientists, and to facilitate the interactions and collaboration between researchers in institutions and the world, a Wide Area Network called the Research and Educational Network (REN) was established in 2000 with the help of the World Bank INFODEV project. REN uses fibre optic as the main backbone (inter-city links) and radio network from a fibre optic access point in each city to the end-user. Presently, the basic infrastructure is functioning satisfactorily with the University of Ghana, Legon-Accra, hosting the main server and a VSAT link to the Internet. Additionally, the following institutions have been linked to serve as nodes for the broad network:

- University of Cape Coast (Central Region)
- Kwame Nkrumah University of Science and Technology (Ashanti Region)
- University College of Education, Winneba (Central Region)
- Center for Scientific and Industrial Research (CSIR), Accra.
- Ghana Atomic Energy Commission (GAEC), Accra
- University of Development Studies, Tamale (Northern Region)

These nodes are serving as service providers to the Senior Secondary Schools who use dial-up access to reach the nodes. Some schools are installing radio links to enhance their connectivity to the nodes. All the nodes have been equipped with a Remote Access Service (RAS) to enable access by other users. Additionally, all the nodes have been provided with the Pentium III server (256 MB RAM, 10 GB HDD and 17" Colour Monitor), a Dial-up modem and 24-port hub. A star topology has been developed with the University of Ghana at the center and the rest linked as follows:

- The Ghana Atomic Energy Commission is linked by a 11Mbit radio modem
- University of Cape Coast:- Fiber optic cable to Cape Coast town and then by a 11 Mbit radio to the UCC campus
- Kwame Nkrumah University of Science and Technology:- Fiber optic cable to Kumasi town and then by a 11 Mbit radio to the KNUST campus
- University College of Education, Winneba:- Dial-up connection
- Center for Scientific and Industrial Research (CSIR): 11 Mbit Radio Modem
- University of Ghana Medical School, Korle Bu:- 11 Mbit Radio Modem
- University of Development Studies (UDS), Tamale linked by a separate VSAT (128 kb/s Downloading, 64kb/s uploading).

The links to the nodes are functioning and Campus Area Networks (CAN) are presently being undertaken at all the nodes to expand the service to all areas on the campuses. The most popular media for the backbone of the CAN is fiber optic cables with CAT 5 UTP cables being used for the intra building networking. The CAN projects are proceeding at a very slow pace on most campuses due to the lack of funds and the absence of trained personnel to undertake the project professionally. As a result only a few points in the whole network are actively functioning and network traffic management is sub-optimal.

The link to the node at the University college of Education (Winneba) is dial-up access due to the fact that its location is not on the national fiber optic backbone and the use of radio would be very expensive. The dial-up connection presently being used is very expensive since access is possible only via a trunk call to the Accra.

Challenges, Opportunities and Potentials

The major challenge facing the development of the full potential of ICT for education, research and development in the country is brain drain which has resulted in the lack of the critical mass of ICT-engineers and scientists relevant for undertaking ICT-related project professionally. Another major obstacle is the lack of an enabling environment and a sound ICT-roadmap and strategies by policy makers resulting in uncoordinated and unsustainable ICT-development activities. Other problems include:

- High running and subscription costs
- Lack of good publicity and incentives to attract potential users
- Identification of information sources that meet the needs of users
- Poor Quality of Service of the internet and telecommunication services
- Regulatory issues (exclusivity policies and ban on use of VOIP)
- Effective management of network traffic and infrastructure

The solution strategy towards bridging the digital divide demands an aggressive human capacity building in ICT through training workshops, seminars and courses in collaboration with local and international institutions [4]. Specific institutions in Ghana responsible for the development of scientific and technological capabilities, research and development, and the provision of essential services are the Kwame Nkrumah University of Science and Technology (KNUST), Council for Scientific and Industrial Research (CSIR), the Ghana Atomic Energy Commission, the Universities of Ghana, the Kofi Annan Centre for Information and Communication Technology. The capacities of these institutions must be strengthened and research and development must be demand-driven focusing on the provision of products to meet local needs. To develop the full potential of ICT in Ghana there is the need for an ICT Taskforce with representatives from all stakeholders:

- To assist policy makers in the formulation of sustainable ICT programs- roadmap
- To manage and co-ordinate activities of the research and educational network
- To develop innovative ideas for the efficient utilization of the ICT infrastructure (e.g. distance education and virtual laboratories for teaching and research)
- To provide training in the use of new ICT tools and
- To promote the use of cost-effective ICT-Technologies such as Open-Source (e.g., www4mail and eJDS) and Wireless Technologies

The benefits of implementing these strategies in an optimal mix can be substantial in helping Ghana realize the required impact of ICT in its socio-economic development.

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