

# Ghana

## Ghana at a glance

Ghana, the former Gold Coast, was involved in the early European coastal trade with West Africa in the 15th century – first in gold and later in slaves. After more than 50 years of colonisation by Britain, Ghana achieved independence on 6 March 1957, becoming the first African country to free itself from a colonial power. Ghana is on the Guinea coast, and shares borders with Côte d'Ivoire to the west, Togo to the east, and Burkina Faso to the north. Its major cities are Accra (the administrative capital) Kumasi, Tema Secondi-Takoradi and Tamale. The climate is tropical, with an annual mean temperature of between 26°C and 29°C.

Ghana covers an area of 239 460 km<sup>2</sup> and has an estimated population of 22 931 299, concentrated primarily along the coast and in the southern cities of Accra and Kumasi. Most Ghanaians are descended from people who probably migrated down the Volta River Valley at the beginning of the 13th century. Ethnically, Ghana is divided into small groups who speak approximately 50 different languages and dialects. Among the more important linguistic groups are: the Akans, which include the Fanti along the coast and the Ashantis in the forest region north of the coast; the Guans, on the plains of the Volta River; the Ga- and Ewe-speaking people of the south and south-east; and the Moshi-Dagomba-speaking people of the northern and upper regions. English is the official and commercial language, and is taught in all schools. The constitution grants every person religious freedom. The main religions are Christianity

(practised by 63 per cent of the population), Islam (21 per cent), and indigenous beliefs (16 per cent). Life expectancy is estimated at 59 years.

The domestic economy is centred on subsistence agriculture, which accounts for 37 per cent of the country's GDP. Gold, cocoa and timber are important sources of foreign exchange. GDP per capita is placed at US\$2 700 and the GDP growth rate at 6 per cent (CIA, n.d.).

**Table 2.1:** Ghana selected key indicators

Indicator	Estimate
Population (2005)	22.1 million
African competitiveness ranking (2004)	10
R&D expenditure as percentage of GDP	Less than 1%
Ministry of Environment and Science budget (2005)	157.7 billion
S&T human resources FTE (est. 2005)	±3 000
Total ISI-journal articles (2001–2004)	641
National adult literacy rate (15 years and over)	57.9%
Global ICT ranking (2005/06)	61

Source: *Research-Africa.net (n.d.)*

## Ghana's ICT infrastructure and connectivity

In August 1995, Ghana became the second country in sub-Saharan Africa to have full Internet connectivity. The country is directly connected to the world's first submarine fibre-optic cable system, SAT-3/WASC/SAFE, which links Africa to Europe and Asia (Research-Africa.net, n.d.).

Network Computer Systems Ltd (NCS) established the first connection. NCS was given its own VSAT (very small aperture terminal) gateway as a result of the constraints experienced by Ghana Telecom (GT). However, the Internet sector's expansion has been seriously constrained by a shortage of functional dial-up phone lines. By 2002, the National Communication Authority (NCA) had licensed 52 Internet service providers (ISPs), although only about ten were operational at that time (Lundkvist et al., 2004).

There have been several e-mail systems in Ghana over the years, which have been based primarily on Fidonet and Unix to Unix CoPy (UUCP). UUCP refers to a suite of computer

programs and protocols allowing remote execution of commands and the transfer of data files and e-mail between computers. With the structural adjustment programme in Ghana and the open economic policy of the government, the telecommunications sector embarked on a programme of privatisation in 1994. NCS received approval from the Ministry of Communications (MOC) to offer value-added e-mail and other services to subscribers in Ghana. As Dzisah (2006: 285) notes:

*The privatisation of Ghana Telecom resulted in a significant growth in the telephone subscriber base from 191,380 in 2000 to about 443,000 in 2005...In spite of this, it is in mobile cellular telephony that Ghana experiences a very rapid growth. There are four cellular service providers competing for customers. The fierce competition in this sector resulted in increased usage from about 702,000 subscribers in 2003 to about 3,408,894 subscribers as at the end of the first quarter of 2006...However, Ghana is still behind in comparison to other technologically-emerging countries such as South Africa and Tunisia.*

Table 2.2 provides a clear comparative picture of Internet usage in Africa.

**Table 2.2:** Internet usage statistics for Africa, 2007

Country	Population (est.)	Internet users (Dec. 2000)	Internet users (latest data)	Penetration (% pop.)	% users in Africa	Use growth (2000–07)
Algeria	33 506 567	50 000	2 460 000	7.3 %	5.6 %	4 820.0 %
Angola	13 313 553	30 000	172 000	1.3 %	0.5 %	473.3 %
Benin	7 714 766	15 000	700 000	9.1 %	1.6 %	4 566.7 %
Botswana	1 893 526	15 000	60 000	3.2 %	0.2 %	300.0 %
Burkina Faso	12 318 213	10 000	80 600	0.6 %	0.2 %	700.0 %
Burundi	8 075 188	3 000	60 000	0.7 %	0.1 %	1 900.0 %
Cameroon	17 775 743	20 000	370 000	2.1 %	0.8 %	1 750.0 %
Cape Verde	494 034	8 000	29 000	5.9 %	0.1 %	262.5 %
Central African Rep.	3 307 622	1 500	13 000	0.4 %	0.0 %	766.7 %
Chad	8 915 381	1 000	60 000	0.7 %	0.1 %	5 900.0 %
Comoros	681 800	1 500	21 000	3.1 %	0.0 %	1 300.0 %
Congo	3 774 537	500	70 000	1.9 %	0.2 %	13 900.0 %
Congo, Dem. Rep.	60 226 717	500	180 000	0.3 %	0.4 %	35 900.0 %
Cote d'Ivoire	20 169 352	40 000	300 000	1.5 %	0.7 %	650.0 %
Djibouti	790 709	1 400	11 000	1.4 %	0.0 %	685.7 %
Egypt	72 478 498	450 000	6 000 000	8.3 %	13.6 %	1 233.3 %
Equatorial Guinea	1 120 061	500	8 000	0.7 %	0.0 %	1 500.0 %

Eritrea	4 254 498	5 000	100 000	2.4 %	0.2 %	1 900.0 %
Ethiopia	73 872 056	10 000	164 000	0.2 %	0.5 %	1 540.0 %
Gabon	1 461 679	15 000	81 000	5.5 %	0.2 %	440.0 %
Gambia	1 508 727	4 000	58 000	3.8 %	0.2 %	1 350.0 %
<b>Ghana</b>	<b>21 801 662</b>	<b>30 000</b>	<b>609 800</b>	<b>2.8 %</b>	<b>1.4 %</b>	<b>1 932.7 %</b>
Guinea	8 171 096	8 000	50 000	0.6 %	0.1 %	525.0 %
Guinea-Bissau	1 492 189	1 500	37 000	2.5 %	0.1 %	2 366.7 %
Kenya	35 062 192	200 000	2 770 300	7.9 %	6.3 %	1 285.2 %
Lesotho	2 513 076	4 000	51 500	2.0 %	0.2 %	1 187.5 %
Liberia	3 146 406	500	1 000	0.03 %	0.0 %	100.0 %
Libya	6 293 910	10 000	232 000	3.7 %	0.7 %	2 220.0 %
Madagascar	18 996 075	30 000	110 000	0.6 %	0.3 %	266.7 %
Malawi	11 553 163	15 000	59 700	0.5 %	0.1 %	298.0 %
Mali	10 914 989	18 800	70 000	0.6 %	0.2 %	272.3 %
Mauritania	2 959 592	5 000	100 000	3.4 %	0.2%	1 900.0 %
Mauritius	1 292 309	87 000	300 000	23.2 %	0.9 %	244.8 %
Mayotte (FR)	194 785	n.a.	n.a.	n.a.	n.a.	n.a.
Morocco	30 534 870	100 000	6 100 000	20.0 %	13.9 %	6 000.0 %
Mozambique	20 356 242	30 000	178 000	0.9 %	0.4 %	493.3 %
Namibia	2 083 405	30 000	80 600	3.9 %	0.2 %	168.7 %
Niger	12 533 242	5 000	40 000	0.3 %	0.1 %	700.0 %
Nigeria	162 082 868	200 000	8 000 000	4.9 %	18.2 %	3 900.0 %
Reunion (FR)	802 911	130 000	220 000	27.4 %	0.7 %	69.2 %
Rwanda	8 959 095	5 000	65 000	0.7 %	0.1 %	1 200.0 %
Saint Helena (UK)	4 662	n.a.	1 000	21.5 %	0.0 %	0.0 %
Sao Tome & Principe	173 942	6 500	23 000	13.2 %	0.1 %	253.8 %
Senegal	11 069 755	40 000	650 000	5.9 %	1.5 %	1 525.0 %
Seychelles	84 927	6 000	29 000	34.1 %	0.1 %	383.3 %
Sierra Leone	5 159 619	5 000	10 000	0.2 %	0.0 %	100.0 %
Somalia	12 448 179	200	94 000	0.8 %	0.2 %	46 900.0 %
South Africa	49 660 502	2 400 000	5 100 000	10.3 %	11.6 %	112.5 %
Sudan	36 618 745	30 000	3 500 000	9.6 %	8.0 %	11 566.7 %
Swaziland	1 173 758	10 000	41 600	3.5 %	0.1 %	316.0 %
Tanzania	38 870 348	115 000	384 300	1.0 %	1.1 %	234.2 %
Togo	5 527 332	100 000	320 000	5.8 %	0.7 %	220.0 %
Tunisia	10 342 253	100 000	1 294 900	12.5 %	2.9 %	1 194.9 %
Uganda	28 574 909	40 000	750 000	2.6 %	1.7 %	1 775.0 %
Western Sahara	456 348	n.a.	n.a.	n.a.	n.a.	n.a.
Zambia	11 486 812	20 000	500 000	4.4 %	1.1 %	2 400.0 %
Zimbabwe	12 398 897	50 000	1 220 000	9.8 %	2.8 %	2 340.0 %
<b>Total Africa</b>	<b>933 448 292</b>	<b>4 514 400</b>	<b>43 995 700</b>	<b>4.7 %</b>	<b>100.0 %</b>	<b>874.6 %</b>

Source: Miniwatts Marketing Group (2007)

Although ICT infrastructure development has not progressed rapidly, Ghana compares favourably with other low-income countries, particularly those in sub-Saharan Africa, in terms of bridging the global divide between it and the developed world. In 2005/06, Ghana was ranked 61st in the World Economic Forum's Global Information Technology Report (WEF, 2006).

According to Opoku (2004: 1): 'the development of ICTs has been argued to provide leapfrogging opportunities for developing countries such as Ghana. Prominently featuring among these initiatives is the development of a national fibre-optic network called the Voltacom Project by the nation's power hub, the Volta River Authority.'

There has been substantial improvement in the telecommunication infrastructure, and Ghana's teledensity increased by 1 200 per cent over the period 2001–2006. However, virtually all of this growth was in the mobile phone industry. Fixed-line teledensity, the main means of accessing the Internet, remains at approximately 3 per cent. (See Arrow Network Systems, n.d.)

Ghanaians have adopted a 'serious attitude' towards the Internet. Pricing may have played a part in conveying the perception that Internet access is expensive and, therefore, more suited for 'serious' purposes. In a recent survey by the NCS, 38.4 per cent of subscribers cited communication as the main reason for using the Internet. This was followed by the ability to access databases (32.9 per cent) and research (16.6 per cent). In other words, more than 85 per cent of users gave these three functions as key reasons for their subscribing to the Internet (Quaynor, Tevie & Bulley, n.d.).

The Ghana Internet Service Providers Association (GISPA) is the only official ICT association currently in operation in the country. In view of the importance of associations in promoting their own interests, professional standards and the pursuit of common objectives, the MOC is encouraging other ICT groups to form associations. These include software development companies, hardware companies, computer instructors and training institutes.

There has been massive investment in ICT infrastructure by existing ISPs and telecommunications companies, such as 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), have trained over a thousand professionals in ICT and related areas to provide the necessary knowledge and skills to support ICT activities in the country. The fixed-line operators are Ghana Telecom and Westel. The mobile operators are Kasapa, Ghana Telecom (OneTouch), Spacefon and Mobitel (Buzz) (Opoku, 2004). Table 2.3 provides a summary of access to telephone services in Ghana and Table 2.4 lists the licensed communications operators and service providers.

Internet penetration in Ghana is very low according to International Telecommunication Union statistics, with 172 Internet users per 10 000 inhabitants in 2004; this, however, was higher than the African average of 123.21 (ITU, 2006). By way of comparison, in 2003 South Africa had more than 3.1 million Internet users and Egypt 1.9 million users, while Ghana had 170 000. Most users in Ghana have access through shared Internet connections, at offices, cyber cafes, friends and, to a lesser extent, homes. Internet cafes are the most important source of Internet access. In early 2003, there were more than 750 Internet cafes in Ghana, mostly using dial-up connections. About 90 per cent of the cafes are located in Accra, with the rest in other cities such as Kumasi and Takoradi. The largest cybercafe is Busy Internet in the central part of Accra, with over 100 computers. The key Internet players are Network Computer System, Africa Online, Internet Ghana and Integrated Digital Network.

Although Ghana achieved 'full Internet connectivity' in 1995, ICT development is still in its infancy in the country. Telephone links to rural areas are still very poor, despite recent advances in wireless telephony. One detrimental factor is the high cost of Internet usage. The three main

**Table 2.3:** Telephone access in Ghana, 2000–2005

Service	2000	2001	2002	2003	2004	2005 (Mar.)	2005 (Nov.)
Fixed-line phones	206	249	270	288	372	324	323
Mobile phones	39	222	383	775	1 189	1 695	2 472
Payphones	3.291	4.487	4.995	4.995	8.846	11.037	11.314

Source: MOC (2005a)

Table 2.4: Communications operators and service providers, 2006

Category	Authorised	Operational
National fixed network operators	3	2
National mobile cellular networks	5	4
Paging services providers	10	n.a.
Internet data service providers	165	29
VSAT data operators	176	57
Direct-to-home satellite services	13	n.a.
Public/corporate data operators	99	25
FM radio stations	137	129
Television stations	32	4 free-on-air 4 pay-to-view

Source: NCA (2006)

ISPs, AfricaOnline, Internet Ghana and Network Computer Systems charge between US\$35 and US\$50 per month for unlimited access dial-up services. Corporate account rates for Internet access range from US\$50 for limited access to US\$300 for unlimited access. Partly in response to these costs, there has been a recent increase in the number of Internet cafes and communication centres across the country (Intsiful, Okyere & Osaе, 2003).

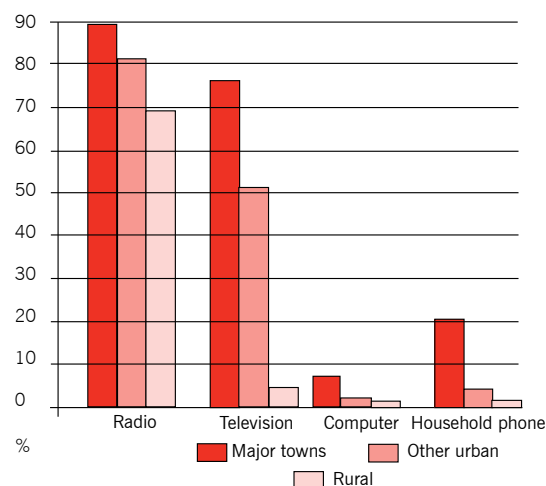
According to Frempong (2004), despite massive investment in ICT infrastructure and ICT capacity-building, Ghana remains largely isolated digitally from the Global Village because it lacks the critical drive and strategies to harness the full potential of ICT for the socio-economic development of the country. Besides cultural and linguistic barriers to the Internet, Ghana faces other problems, the first of which is that much of Africa lacks advanced infrastructure. NCS, the primary service provider, has a 2Mb-capacity satellite circuit to MAE-EAST in Virginia, landing directly on the UUNET backbone. This circuit completely bypasses the existing Ghana Telecom infrastructure, which is limited in data capacity for Internet access. The granting of this special licence to NCS has made faster access to the Internet possible.

On the whole, Internet access is increasing, but another critical factor limiting household access to the Internet is the investment involved. Although it is possible to purchase a second-hand 'Internet-ready' computer for around US\$200–US\$300, it is still expensive for the majority of Ghanaians. According to Ahiabenu (n.d.), a typical Web user has to pay a monthly subscription fee averaging US\$30 for unlimited access and one email account, plus a telephone usage rate of ¢200 (US\$0.03) per minute.

Corporate bodies are fortunate to have had the recommended computer penetration, and the local area networks are in place for business to take advantage of the infrastructure needed for full connectivity. However, the real growth required in Internet access concerns home usage, which is very low, as demonstrated in Figures 2.1 and 2.2.

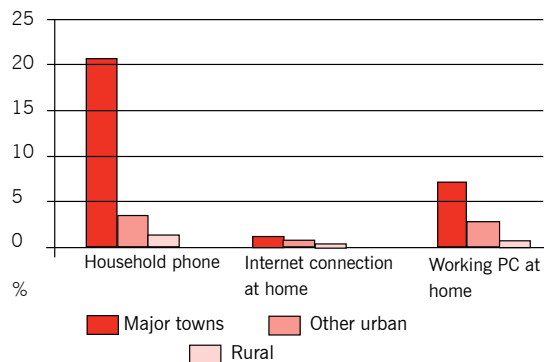
Ghana Telecom, the national carrier, which is supposed to be at the forefront of ICT development, is certainly struggling and has failed to keep up with the times. For the past three years, the carrier has faced a number of

Figure 2.1: Computer, Internet and fixed-line phone penetration at home



Source: Frempong et al. (2005)

Figure 2.2: Household ICT appliance penetration



Source: Frempong et al. (2005)

challenges, ranging from voice-over-Internet protocol (VOIP) to international traffic termination issues. These difficulties have led Ghana Telecom's international revenue to drop by as much as US\$15–US\$30 million per year. Other factors such as bad debt, which is estimated to be as high as US\$40–US\$45 million annually, in addition to bad management, are hampering efforts to operate this critical organisation more efficiently and competitively. In 2003, Mr Albert Kan-Dapaah, Minister of Communications and Technology, indicated that Ghana needed about US\$800 million to improve telecommunication infrastructure to support the development of the ICT industry. He added that investment in the telecommunication sector had been declining, thus delaying infrastructure expansion and slowing the deployment of value-added advanced ICT services (Ghanaweb Business News, 27.05.03).

Furthermore, according to Opoku (2004: 4):

*one critical hurdle has been the lack of enabling environment and the political will to do things. It is interesting to note that Ghana governments have been described in certain circles as a bad virus to ICT development. Also, Greg Pascal Zachary (2004), in his forward looking paper Black Star: Ghana, Information Technology and Development in Africa made it clear that cynicism about the potential for policy to make a difference is widespread and even when the policies are correct; government faces the difficulties getting things done. Ghana can now boast of a National ICT Policy document but more needs to be done. Some of the questions that need answers and reflection among others are: Does Ghana have the political will, resources, both money and human, to embark on the ICT4AD priority areas? Does the country have the right government, leaders and policy implementers who will defy all odds to create the necessary structures for ICT to take off and to make this dream a reality?*

## National ICT policy development in Ghana

In 2003, the Ghanaian government, through the National ICT Policy and Plan Development Committee of the MOC formulated an ICT policy – Information and Communication Technology for Accelerated Development (ICT4AD), which was ratified and adopted in January 2004. This policy is the foundation upon which Ghana's vision for the information age has been built.

Among numerous policy goals for different sectors of the economy is the deployment and exploitation of ICTs in education. One of the specific objectives of the policy statement is to promote and encourage distance education, including electronic distance education and virtual learning, focusing on tertiary level education and training in all fields and disciplines to broaden access to educational and training resources and services for a larger section of society.

The implementation of the policy deserves greater attention. Rajesh (2003) remarks, in connection with the need for effective implementation of policies, that the road to failure is often paved with good intentions. It is hoped that an ICT-enhanced distance education policy will not remain merely an intention on paper and on the Web but will be translated into reality.

The formulation of the ICT4AD takes into account the aspirations and provisions of key socio-economic development framework documents such as Ghana's Vision 2020 – the First Step; the Ghana Poverty Reduction Strategy (2002–2004); and the Co-ordinated Programme for Economic and Social Development of Ghana (2003–2012) (Abissath, n.d.).

Specific focus areas, or sub-plans of the ICT4AD's Development Action Plans, have been outlined. These include the:

- E-Government Sub-plan;
- Accelerated Human Development Sub-plan;
- E-education Sub-plan;
- Private Sector Development Sub-plan;
- E-Commerce Development Sub-plan;
- E-Health Sub-plan;
- ICT and Physical Infrastructure Development and Roll-out Sub-plan;
- Legal, Regulatory, Institutional Provisions and Standards Sub-plan;
- Industrial, Scientific Research Drive and Promotion Sub-plan;

- Foreign Direct Investment (FDI) Drive in ICTs;
- E-Security Sub-plan; and, above all,
- ICTs-in-Community Sub-plan. (Abissanth, n.d.)

The government planned to establish at least two fully operational community information centres (CICs) in each of the country's ten regions by the end of 2007. These centres were to be properly equipped and staffed by people with the requisite ICT skills and managerial capacity. The CICs would not only provide Internet and e-mail access, but would also afford rural people the opportunity of acquiring training in basic computer literacy (Abissanth, n.d.)

Indeed, the overall vision of the ICT4AD policy is:

*To improve the quality of life of the people of Ghana by significantly enriching their social, economic and cultural well-being through the rapid development and modernization of the economy and society using information and communication technologies as the main engine for accelerated and sustainable economic and social development. (Republic of Ghana, 2003: 21)*

According to the MOC's Policy and Plan Development Committee policy statement, the main vision of ICT4AD is:

*To transform Ghana into an information-rich, knowledge-based and technology-driven high-income economy and society. Some of the key sub-missions of the vision are:*

- *To develop Ghana's information and knowledge-based society and economy through the widespread development, deployment, and exploitation of ICTs within the society and economy.*
- *To transform 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 develop Ghana's research and development (R&D) capacity and capabilities with the potential to conduct and engage in advanced and cutting-edge R&D work required for supporting the development of a globally competitive information, knowledge-based and high-tech export industry and services.*

*The Government is committed to pursuing a number of key strategies towards the achievement of the stated missions of the vision. Key among them are strategies to:*

- *Transform Ghana into an information and knowledge-driven ICT literate nation;*
- *Promote the deployment and exploitation of information, knowledge and technology within the economy and society as key drivers for socio-economic development;*

- *Modernize Ghana's educational system using ICTs to improve and expand access to education, training and research resources and facilities, as well as to improve the quality of education and training and make the educational system responsive to the needs and requirements of the economy and society with specific reference to the development of information and the knowledge-based economy and society; and*
- *Improve the human resource development capacity and the research and development (R&D) capacity of Ghana to meet the demands and requirements for developing the nation's information and knowledge-based economy and society. (MOC, n.d.)*

The key role that ICTs can play in educational delivery and the need for ICT-training and education in schools, colleges and universities is clearly recognised, as is the potential of ICTs in literacy education and general improvement in the educational system as a whole (MOC, n.d.).

In particular, the MES is committed to the implementation of programmes and initiatives aimed at facilitating the process of 'ICTs in Education', in particular the use of ICTs in teaching and learning at all levels within the educational system.

## E-government

E-government signifies the electronic or online provision of public services to citizens. Much has been said about the potential of ICT in Ghana – how it can speed up the achievement of the millennium development goals, stimulate economic growth, create jobs, increase export revenues and, most importantly, improve the delivery of government services.

With the support of the World Bank, Ghana has developed the e-Ghana Project, which is aimed at supporting concrete initiatives in the country's ICT-led socio-economic development. The e-Ghana Project has three components: an enabling environment; business outsourcing and promotion of local ICT business; and e-government applications and intra-government communications (see MOC, 2005b).

Chief Director of the MOC, Yaw Kutor has stressed that improving intra-government communications is essential for the implementation of an e-government system. He is confident that the e-Ghana project will support the establishment of a government-wide network and messaging system, building on pilot projects already initiated to connect ministries, departments and agencies (MDAs) within the ministerial enclave (see MOC, 2005b).

Shared infrastructure and services can significantly reduce the cost of developing and managing e-government applications. Thus, the project will upgrade the existing government portal infrastructure into one consisting of a data centre (with a backup centre), a payment gateway, and security and authentication systems with load-balancing capabilities. This shared infrastructure will assist in reducing departmental costs, improve database security and facilitate accessing government databases for service delivery (MOC, 2006).

After implementation of Ghana Community Network Services (GCNet), which offers ICT-based solutions for the development of trade and revenue generation, the e-Ghana project will focus on rolling out a minimum of five e-government applications using public-private partnerships (PPPs) to modernise and enhance selected government services such as business, land and vehicle registration, revenue mobilisation, immigration services, payroll applications and e-procurement (MOC, 2006).

Under the Public Financial Management Reform Programme, the government is establishing a data centre at the Ministry of Finance in Accra. This project will involve linking a wide-area network (WAN) to 42 other sites in Accra and the rest of the country. The network aims to cover all government departments and agencies, acting as a source of data for the government's financial systems (Lundkvist et al., 2004).

The government has also launched its own portal ([www.ghana.gov.gh](http://www.ghana.gov.gh)), which aims to 'provide across the board information to the public and elicit their feedback and suggestions toward the attainment of good governance'. While inaugurating the web site, Vice-President Mahama underscored the prominent role of ICT in development by saying that 'if we do not dot com, we shall be dot dead' (Oderberg, Jensen & Sintim-Misa, 2003).

## Higher education

### Overview of Ghana's education system

Julius Nyerere, the first president of Tanzania, famously observed: 'colonial education is motivated by the desire to inculcate the values of the colonial society and to train individuals for the service of the colonial state'. In Ghana, the training focused on producing clerks for the agricultural sector (particularly the export market), missionary proselytising activities and the colonial civil service. 'Technical education, geared towards innovation and creative purposes was not on the colonial agenda' (Dzisah, 2006: 381). Ghana's limited education system remained unchanged until 1987, when

basic education was reduced from 17 years to 12, and the duration of study for a first degree at university was increased from three to four years. The aim of these educational reforms was to increase access and enrolment, and to encourage vocational and technical education (Dzisah, 2006).

Enrolment has increased, but as Ghana's technology achievement index illustrates, the critical mass of skills in science, mathematics and engineering is still far below that of most developing countries. In spite of the strides being made in terms of enrolment, inadequate equipment and lack of qualified staff have made the implementation of the science, mathematics and technical-vocational programmes ineffective (Dzisah, 2006).

Dzisah (2006) stresses the need for Ghana to institute educational policies that support the attainment of skills in innovation and adaptation of ICTs, as well as mechanisms of sustaining such policies through greater funding of research and development.

According to the *Ghana Science and Technology System Profile*:

*Higher education in Ghana is provided by universities, university colleges, polytechnics and pre-service training institutes. All institutions of higher education fall under the jurisdiction of the National Council for Tertiary Education, which is administered by the MES. At the time of independence, Ghana had only one University College (now the University of Ghana, Legon). Today there are six public universities and the Ghana Telecommunications University College which was established in 2006. (Research-Africa.net n.d.)*

Dzisah (2006) presents the data in Table 2.5 to demonstrate the growth in enrolment figures at educational institutions in Ghana.

**Table 2.5:** Enrolment at educational institutions

Institution (number)	1990	1995	2000	2005
High school (503)	167 640	209 190	204 627	333 002
Polytechnic (10)	n.a.	n.a.	20 422	24 983
University (5)	9 251	18 000	40 637	73 410

Source: Dzisah (2006: 382)

The following is a comprehensive list of tertiary institutions in Ghana (see GETFund, n.d.):

#### Public universities

1. University of Ghana
2. Kwame Nkrumah University of Science and Technology
3. University of Cape Coast
4. University of Development Studies
5. University College of Education

#### Public polytechnics

1. Kumasi Polytechnic
2. Sunyani Polytechnic
3. Koforidua Polytechnic
4. Ho Polytechnic
5. Takoradi Polytechnic
6. Cape Coast Polytechnic
7. Accra Polytechnic
8. Wa Polytechnic
9. Bolgatanga Polytechnic

#### Private tertiary institutions

1. Ghana Christian College & Seminary
2. Valley View College
3. Academy of Business Administration
4. Accra School of Economics & Political Science
5. Christian Service College
6. Akrofi Christian Memorial Centre for Mission Research & Applied Theology
7. Central University College
8. Trinity Theological Seminary
9. West Africa Computer Science Institute
10. College of Arts & Science
11. University College of Wisconsin International, University of Ghana
12. Methodist University College
13. Islamic University College, Ghana
14. Institute of Management Studies (Accra & Kumasi)
15. Graduate School of Management
16. Maranatha Bible College
17. Ashesi University College
18. NIIT Education & Training Centre
19. Ghana School of Marketing
20. Resource Development International
21. All Nations University College
22. Catholic University College
23. Presbyterian University College
24. Ghana Baptist Theological Seminary
25. Intercom Programming & Manufacturing Company
26. Premier Institute of Law Enforcement & Administration
27. Zemit College

## ICT education

Science and technology education in Ghana has been fairly restricted. Until recently, engineering was taught only at Kwame Nkrumah University of Science and Technology (KNUST) (Dzisah, 2004); even at the University of Ghana, students did not have access to computers until 2003. Prior to that, students were forced to use expensive private Internet cafes for their online research.

This demonstrates the low technological achievement and level of industrialisation in the country, and specifically at institutions of higher learning. The faculty of engineering at KNUST was established in 1952, and today offers a four-year bachelor of science degree and a two-year master's degree in science. The teaching focuses on three areas: electricity and power; electronics and communications; and computers and control. Traditionally, civil and mechanical engineering have attracted the most engineering students in Ghana, a reflection perhaps of the rural and heavy industrial orientation of the country's economy. However, since the rise of the global ICT revolution, KNUST has encouraged electrical engineering and computer science to stimulate the formation of new industries (Dzisah, 2006).

As Dzisah (2006: 382) observes:

*The university has gradually shifted its emphasis from mechanical and civil engineering to electrical engineering and computer science. As a result, interest in electrical engineering has grown dramatically. The number of electrical engineering graduates from KNUST more than doubled from a mere twenty-four in 1997 to fifty-two in 2000. In 2005 there were about 1,094 students enrolled in engineering courses at the university...As part of the educational reforms, six polytechnics have been upgraded to offer tertiary degrees and higher national diplomas. These polytechnics have begun training some students in engineering. In 2004, the University of Ghana enrolled its first batch of twenty-five students to the newly established Faculty of Engineering Sciences. The faculty has five specialities: Agriculture Engineering, Biomedical Engineering, Computer Engineering, Food Process Engineering, and Materials Sciences Engineering.*

The newly created Ghana Telecom University College (GTUC) is proposing to establish centres of excellence in telecommunication and information nationwide. This would position the university to be more competitive and attractive to local and international students. As part of its technological innovation strategy (New Technologies as Learning Agents), the college is also to introduce online distance education options that would enable students to

'attend' lectures via videoconferencing at various locations. GTUC's principal, Dr Osei Darkwa, is certain that these developments would facilitate tapping into global teaching resources. Dr Darkwa was quoted as saying:

*By devising and implementing a distance learning strategy through the use of new technologies as learning agents... soon it would be possible for students of the College to go to community learning centres, tele-centres, churches, schools or a local business in most major cities and towns to use computers with the institution's faculties... This vision is realistic and represents hope for the millions of Ghanaians and Africans who are looking for access to higher education and nothing will stand in our way in making this vision a reality (Soul Hour, 2007).*

In collaboration with the Danish Technical Institute, the college will begin a master's programme in information communication technology in October 2007, the first of its kind in the country. The college is affiliated to KNUST and the Massachusetts Institute of Technology in the United States of America, and has attracted over 500 tuition-paying students in Ghana. Since its inauguration in August 2006, a total of 213 students have completed certificate studies in various ICT courses, such as telecommunication engineering, computer science, computer forensics and information technology, business processing, outsourcing and open-source software (see [www.gtuc.edu.gh](http://www.gtuc.edu.gh)).

Dzisah (2006: 383–84) notes:

*While these information and technological developments appear quite promising, it is important to note that Ghana is not investing enough in the training of students in engineering and other science-related disciplines. The lack of investment in these critical mass skills is a factor in the low technology achievement and marginalisation from the global information-based economy...*

*In view of the dynamism of the discipline and the inability of the universities and polytechnics to cope with developments in the industry, some corporate bodies and allied institutions have set up training centres to bridge the gap between skills acquired at the conventional training centres and skills required in industry... The major setback facing this largely uncoordinated private sector is the prohibitive tuition costs, making it difficult for most ICT enthusiasts to go through all the required modules...*

*However, recent trends are showing Ghana's desire not to be left out of another technological revolution. To propel ICT as the prime mover of its economy, the government of Ghana*

*has signed a bilateral agreement with the government of India to assist Ghana with its expertise in ICTs. As a result of this agreement, the government of India in 2003 established Ghana's first Advanced Information Technology Institute (AITI) named the Ghana–India Kofi Annan Centre of Excellence in ICT (KACE). It should be noted that the Indian government provided state-of-the-art computer hardware, software and other communication equipment, as well as training for instructors and the curriculum. This partnership comes at a critical time when the UNDP in its 2001 report noted that Ghana was producing less than 10 per cent of the required engineers and technicians. It is, however, expected that the AITI will expand Ghana's technology base in order to accelerate its socio-economic development.*

In addition, the Indian government has established the Pan African e-Network Project for Tele-education and Tele-medicine, and has appointed the University of Ghana and KNUST to host this project as part of a five-year plan. The network will consist of five regional universities and 53 learning centres in countries across Africa. Six Indian universities (Indian Institute of Science, Indira Gandhi National Open University and the Universities of Delhi, Mumbai, Calcutta and Madras) will be linked into the network. Courses offered range from diploma-level to postgraduate studies in different disciplines and can be chosen by each country in accordance with its priorities and national education strategy (Indian Embassy, 2007).

Having Internet connectivity is one thing, maximising utilisation of the tool is another. Professor Kwame Boafo-Arthur of the Department of Political Science at the University of Ghana has argued that many university lecturers are not computer literate and some are unable to use the Internet even for basic communication via e-mail. The implication of this is that use of ICTs for academic research and teaching is very limited. Boafo-Arthur says that even amongst those who claim to be computer literate, knowledge of the multifunctional applications of computers is restricted. This is due to a lack of formal training. Any training that educators may have gained has been acquired, for the most part, through informal self-teaching during visits to foreign universities. Limited access to computer hardware further restricts proficiency. Computers are expensive in Ghana and beyond the reach of most educators; and when people do have access to computers, Internet connectivity is generally not available (Boafo-Arthur, 2006).

The Ghana Academic and Research Network (GARNET) now connects three of the major academic institutions in Ghana. It is funded jointly by UNESCO, the ITU and USAID.

According to Quaynor, Tevie & Bulley (n.d.): 'This network will interconnect all three universities to the backbone, making it easy for them to serve as champions of online connectivity and also expose students and lecturers to the Internet early'. They observe that, as a result of these network advances, scientific and technological development will be enhanced and ties between the universities will be further strengthened. Commercial networks connected to GARNET will also benefit from this project, as their regional traffic will flow without the restrictions and delays caused by slow terrestrial links.

In March 2004, the Ghanaian government signed a memorandum of understanding with Microsoft Ireland to form a public-private partnership to help bridge the knowledge and digital divide in Ghana, creating an ICT-literate workforce, and helping students, teachers and the broader community to realise their full potential. Microsoft agreed to establish an ICT support centre at the University of Ghana (based on its ICT infrastructure and literacy levels). The company would then train ten students to operate the support centre for the first year, provide reference materials for helpdesk services via e-mail and/or telephone, and helpdesk accreditation. It is not certain whether this project has been implemented yet.

## Teaching and learning

With regard to recent developments in ICTs and education, in particular the E-Schools and Community Initiative, Nyarko (n.d.) notes:

*At the beginning of the millennium, education authorities in Ghana embarked on a number of projects to introduce Information and Communication Technologies (ICTs) into the Ghanaian education set up; especially at the basic and secondary school levels. For instance, in the middle of the 1990s, educational providers realised that Ghanaian professionals could not compete on the global market for jobs, because they were limited in skill, especially in the area of Information Technology. Subsequently, the authorities incorporated the study of ICTs as part of the study of science. The government of Ghana with the collaboration of Non-Governmental Organisations (NGOs), philanthropists and Parent-Teacher Associations (PTAs) built about 110 science resource centres to aid the teaching of science and ICTs. However, initiators found that the various programmes were disintegrated, unstructured and did not cover all the schools... The Ghana Education Service under the e-schools initiative has therefore given approval for any school to charge an*

*amount of not more than 30,000 cedis (\$3.2) per student per term to facilitate re-sourcing schools to speed up the process. The government of Ghana has also secured a Chinese loan and is building a national fibre optic backbone to aid connectivity throughout the country, increase bandwidth and reduce call drops and the cost of accessing Internet and telephone services...*

*In the meantime, a NEPAD initiated e-schools programme for African countries has come on stream to introduce ICTs into all aspects of learning in six deprived secondary schools in six of the ten regions. Under the NEPAD E-Schools Initiative, two consortiums – Cisco and Oracle – are funding three schools each selected from the Volta, Ashanti, Western, Upper East and Upper West and the Brong Ahafo regions. The two consortiums have already trained teachers, provided connectivity and other supporting devices necessary to aid e-learning in the six secondary schools under the Initiative which is currently at a demonstration stage...*

*The managers of the e-schools initiative have also come into an agreement with Microsoft to develop software purposely for the e-schools programme. Microsoft has since 2005 provided operating and application software and indeed the whole of the Microsoft office package for \$4 each and distributed it through its agent in the country. Most of the software has been deployed to institutions undertaking the e-schools initiative, and all tertiary institutions which offer teacher training such as Winneba University College and University of Cape Coast also enjoy the rebate. (Nyarko, n.d.)*

Another ICT education success story is the Global Teenager Project Ghana (see [www.globalteenager.org.gh/](http://www.globalteenager.org.gh/)), which has been able to facilitate structured exchanges between schools and teachers using the Internet. The aim is to encourage intercultural awareness and understanding. The project uses ICTs to connect both local and international teachers and students to develop educational content, promote cross-cultural learning and increase ICT literacy among young people.

The project is targeted primarily at the youth but extends to their educators by promoting new ways of learning, new teaching methods, local capacity development and networking using ICTs. It is expected that the project will:

- increase awareness among stakeholders in the education sector;
- increase the numbers of teachers and students benefiting from ICT usage in teaching;
- improve the quality of the content taught in Ghanaian schools; and

- in the long run, form as a basis for the inclusion of ICT in secondary school curricula.

The learning circle is the key operational tool used. This is an interactive Internet and e-mail platform where students and teachers meet to research, discuss and exchange ideas, and ultimately find answers to learning problems. The learning circles provide interfaces in English, French and Spanish to facilitate cross-cultural learning. The project has proved very popular and interest has been sustained. This is attributed to the Global Teenager web site competition – an innovative way to train students and teachers in web site development. Three students and a teacher receive training in Web development prior to the competition and at the end of the selection process, each school has its own web site. Project partners are Rescue Mission Ghana, Schoolnet Africa and Thinkquest Africa (see [www.globalteenager.org.gh](http://www.globalteenager.org.gh)).

The NIIT Education and Training Centre is a privately run facility and is currently Ghana's largest ICT training institution. It has three centres and the capacity to train over 2 000 students per annum. NIIT is also an ORACLE university partner for Ghana. While it has been reported that NIIT is following the general trend in the country of deteriorating standards, it is uncertain whether this is indeed the case (Lundkvist et al., 2004).

The World Links for Development (WorLD) programme is a World Bank-initiated and sponsored project. Introduced in Ghana in 1997, the programme was designed to use ICTs to open a world of learning for teachers and students. The programme aims to assist teachers and students to integrate ICTs into their curricula, to facilitate collaborative projects and distance learning among teachers and students, to assist students in using computers and the Internet as communication and research tools, and to develop local educational content on the internet (Kwei, 2001).

## Recent initiatives

At a Research ICT in Africa workshop held in 2007, Ghana's Minister of Education, Science and Sports, Papa Owusu Ankomah, announced that the government would be introducing universal ICT education into Ghana's core educational system in September 2007. The minister made the announcement while opening the workshop for researchers from Ghana and neighbouring countries to consider Ghana's future policy on ICT (Barton, 2007).

He noted not only that proficiency in ICT was becoming a prerequisite for securing employment, but that he had authorised an extension of ICT knowledge to the remotest parts of Ghana through his department's ICT for Development programme.

As mentioned earlier, the governments of India and Ghana have collaborated to establish KACE. The centre is focused on training specialists and retraining engineers in ICT. It also expects to enhance the public's knowledge of computers.

The centre:

- offers specialised undergraduate and postgraduate programmes in ICT and related fields;
- supports postgraduate programmes offered by other universities, such as the MBA in Information Management or Information Systems at the University of Ghana;
- produces highly skilled, hands-on IT engineers, administrators, project managers and technicians to meet the growing demand in the market;
- acts as a bridge between academia and the industry by developing ICT skills based on practical, hands-on training;
- promotes the growth of the ICT industry in Ghana; and
- provides programmes for IT professionals of all levels to enhance their skills (Martey, 2006).

## E-learning

In the past, distance education relied on printed media and the postal service. Few higher education institutions offered distance learning courses. As a result of ICT, many more universities worldwide are offering distance education courses (Stuart, 2003).

In distance education, ICTs (radio, television, cellular phones, computers and satellite systems) have the following useful applications:

- preparing and presenting lectures;
- creating portals to provide technical and methodological assistance to academics for developing ICT-based courses;
- providing videoconferencing facilities for the distance learners; and
- enabling libraries to automate their systems, digitise resources and provide remote access to information for users via the Internet.

E-learning centres based in Ghana include the University of Ghana, Ghana Institute for Management Public Administration (GIMPA), British Council Ghana, and 2Ti Solutions Limited/Busy Internet. Other centres hosted outside Ghana, but which target Ghanaian students include the University of Sunderland, eLeap Learning Management System, and the Lions Gate Learning Alliance. Apart from the University of Ghana and GIMPA, which have developed

their own learning modules, the rest are linked to online learning centres outside the country. For example, the British Council's e-learning portal links Ghanaian students to portals of educational institutions in the United Kingdom. In addition, 2Ti Solutions has established a portal ([www.elearningghana.com](http://www.elearningghana.com)) that is linked to several global online training and education providers for small and medium-size enterprises (KACE, n.d.).

Admittedly, ICTs are not being used extensively in distance education in Ghana at present (Martey, 2006). There is, however, much optimism and rhetoric about the potential of technology-enhanced distance education. It is hoped that, in the very near future, ICTs will be used extensively to provide education for many more Ghanaians who want to study.

For some time, political leaders and educationists have been highlighting the benefits the country will derive from the adoption of ICTs in distance education. At an ICT in education policy-maker's workshop in 2002, the Ghanaian Minister of Education aired his views on distance education facilitated by technology as follows:

*ICT creates the opportunity for governments to provide distance-learning programmes which make it possible for many more people, located far from the centre of learning, to educate themselves. With the inability of the country's public universities to admit about 60 per cent of qualified applicants each year due to inadequate infrastructure and teaching personnel, an efficient use of ICT in education would be an important asset for the promotion of distance education in all educational institutions. (Worldcomputerexchange, 2002)*

However, not much is being said about the challenges facing ICT-driven distance education. Perhaps the benefits are seen to outweigh the disadvantages. It is evident that progress towards the implementation of ICT-based services in libraries and distance education in Ghana has been slow for several reasons, principally the high cost of information and communication infrastructure and the lack of technical expertise. According to Rajesh (2003), it has been argued that countries that have paid relatively little attention to IT generally are lagging behind in applying new technologies to education.

The African Virtual University (AVU) has member sites at the University of Cape Coast's Centre for Continuing Education, KNUST, the Ghana Institute of Management and Administration, the University of Ghana and the University of Education. The AVU sites are expected to use technology extensively in their distance learning activities. Unfortunately, according to Stuart (2003), this does not appear to be the

case for some of the sites. The University of Cape Coast and the University of Education are yet to make full use of ICTs, and rely heavily on printed course materials for their distance learning programmes.

In 2007, a broadband wireless Internet and voice telephony facility (KNUST E-Campus Network) was introduced at the KNUST campus in a joint venture between Universal Telephone Exchange Limited and Engineering Systems and Services Limited, in collaboration with KNUST. The facility has the potential to transform teaching and learning on campus, providing the university community with in-room and on-campus wireless Internet and voice telephony. It is also expected that the current range of services provided under the KNUST E-Campus Network will complement distance learning (see MOC, 2007).

The British Council has created learning opportunities for Ghanaians by establishing learning centres in Accra and Kumasi. The Accra Learning Centre, for example, has a multimedia learning zone equipped with high-speed Internet access to help students with their distance learning and professional courses. The centre also houses textbooks, multimedia materials and learning aids, interactive resources, revision material, syllabi and other support material (see British Council, n.d.).

## Higher education ICT challenges

According to Intsiful et al. (2003: 4), the major challenge facing the development of ICTs in Ghana's education, research and development sectors is brain drain, 'which has resulted in the lack of the critical mass of ICT-engineers and scientists relevant for undertaking ICT-related projects professionally'. It has also been established that the most talented people in the area of science and technology have either left Ghana for more attractive environments or are pursuing careers in the private sector. They continue:

*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 as further obstacles. 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. 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. (Intsiful et al., 2003: 4)*

## Conclusion and the way forward

Clearly, Ghana faces many challenges in ICT development. Only half a million people in the country are active computer users. Ghana's universities produce an average of 300 computer science and engineering graduates a year, most

of whom, until recently, received computer training and tuition via blackboard teaching and a limited number of outdated computers. In order to begin meeting Ghana's ICT challenges, it is estimated that a million personnel need to be trained, and an additional million PCs and telephone lines need to be in place. It is estimated that this will cost US\$2 billion. It is vital that awareness of the country's ICT development agenda is heightened in all organs of government – the executive, the legislature and the judiciary – and the press (Opoku, 2004).

Opoku (2004) believes that those institutions responsible for the development of scientific and technological capabilities, research and development, and the provision of essential services (such as KNUST, the Ghana Atomic Energy Commission and KACE) need to be strengthened, and must set their focus on demand-driven initiatives in order to provide the products necessary to meet local needs. Computer science departments at Ghana's universities are under-performing. They should be centres of excellence, providing trained ICT professionals for the country, as well being strongly research-driven. Research should be focused on developing innovative ideas for the efficient utilisation of ICT infrastructure in distance education, creating networks across the country and establishing virtual laboratories for teaching and research. Therefore, the academic environment should be made attractive for ICT specialists.

Universities and the research institutions should be in a position to select outstanding young Ghanaians with strong entrepreneurial and policy backgrounds, and who have the potential to become future leaders in ICT development. It is important that these individuals create a collaborative environment, establishing networks within and outside Ghana (particularly with the country's large diaspora community abroad), which will help in the identification of challenges and the implementation of appropriate strategies (Opoku, 2004).

The press has an important role to play as a watch-dog, as a disseminator of policies and programmes, and as a constructive critic when necessary. It is well placed to highlight the investment potential of Ghana, as well as the country's ICT development achievements to date (Opoku, 2004).

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