Deployment of Sustainable ICT Infrastructure in Nigeria Vis a Vis the Nation Building

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Abstract

Information and Communication Technology (ICT) is the bedrock for national survival and development in a rapidly changing global environment, and challenges us to devise bold and courageous initiatives to address a host of vital socio-economic issues such as reliable infrastructure, skilled human resources, open government and other essential issues of capacity building. In addition, an Information and Communication Technology policy built on reliable human resources and infrastructure constitutes the fundamental tool and means of assessing, planning, managing development change and for achieving sustainable growth. *It* is on this premise that this paper seeks to empirically investigate the extent of deployment of sustainable ICT infrastructure in Nigeria in order to ascertain its impact on the development of the nation in general. *With* proper deployment of these devices a lot of gains would be accrued to the nation because the country would have positively responded to the emerging global reality and thus avert becoming a victim of the digital divide.*A* developing nation like Nigeria that aspires to participate effectively and become a key player in the emerging Information Age needs to have in place, a highly efficient Information and Communication Technology system driven by a vibrant national IT policy. This could be achieved through the availability of the required supporting Infrastructure and capacity building.

Keywords

Deployment, Sustainable, ICT Infrastructure, Nation Building

1. Introduction

There is no doubt that we are in the information age. The ever increasing volume of information generated daily in different formats and accessible from different electronic media gives credence to this assertion. Our world is gradually but steadily transforming into an information society; a world where information is the essential element of production and wealth creation. The World Summit on Information Society described an information society as one in which there is equitable access to information and highly-developed Information and Communication Technologies (ICTs) that can improve the quality of life and opportunities for all people. Therefore, global quest for ICT for development is enormous to both urban and rural communities because ICT skills are critical to the success of enhancing national development in a globalised era (World Bank, 2006). In this regard, governments in developed and developing societies strive to create opportunities for citizenship participation in ICT training, knowledge and skills acquisition, and general application and usage of ICT tools to solve problems, promote their wellbeing and enhance national growth. Furthermore, rudimentary intermediate-level ICT skills necessary to function optimally in basic computer-related environments are crucial to national competitiveness in a developing context. The supply of these skills provided predominantly by private, non-state institutions in most developing contexts is considerably under-researched, argues Atchoarena and Esquieu (2002). Several attributes have been given to Information and Communication Technology (ICT), Communication, Information Technology (IT) but they all focus generally in one direction, i.e. to aid in human development, growth and facilitate standard and effective living.

Bialobrezeska & Cohen (2003) regarded ICTs as technologies that generally support an individual's ability to manage and communicate information electronically, and include hardware such as computers, printers, scanners, video recorders, television, radio, and digital cameras; as well as the software and systems needed for communication, such as the Internet and e-mail.

Information technology (IT) is "the study, design, development, application, implementation, support or management of computer-based information systems, particularly software applications and computer hardware", according to the Information Technology Association of America (ITAA, 2008). Today's professionals in information technology obtain training skills and certification in performing several roles in the areas of installing applications to designing complex computer networks and information databases multimedia applications, processes, computer software, computer hardware, programming, data constructs, among others. The public/private enterprise, educational systems and non-governmental institutions are not left out in the quest for ICT development, applications and usage in facilities environments. Private/public different and enterprises, non-governmental agencies and industrial concerns have embraced ICT to solve problems, earn revenue and improve work and productivity in the workplace. A few of the duties that IT professionals perform may include data management, networking, engineering, computer hardware, database and software design, as well as management and administration of entire systems. Technology can help an organization improve its competitive advantage within the industry in which it resides and generate superior performance at a greater value (Bird, 2010). The personnel of these establishments integrate technologies such as the use of personal computers, assistive technologies, cell phones, televisions, automobiles, specific electronic gadgets, and many others, to provide services, attend to problems, handle work demands and increase productivity. Therefore, these workers and professionals in IT deals daily, with the use of electronic computers and computer software to securely convert, store, protect, process, transmit, input, output, and retrieve information. Those who do not possess skills are required to learn and acquire training on their applications and general usage. This is a major problem hindering capacity building in Africa, which includes Nigeria a nation with millions of people, high illiteracy rates and several individuals with disabilities nation. Communication involves the interactive exchange of information, ideas, feelings, needs, and desires, states Heward (2009); adding that, communication involves a message, a sender who expresses the message, a receiver who responds to the message. In this regard, communication functions solely to facilitate the process of narrating, explaining/informing, requesting and expressing information, materials and items which human beings encounter daily in life. It means that when a sender transmits a message to a receiver through some media could be via word of mouth, telephone, text messaging, fax, telegraph, written expression and other multimedia channels. The receiver then decodes the message and gives the sender a feedback. As far as literacy, non formal education and special education are concerned, individuals acquire life skills and use various modes of communication; for instance there are verbal and non-verbal means of communication. i.e. auditory

means, like speech, song, and tone of voice, and the visual/non verbal/physical means, like using sign language, body language, eye contact, touch; through different media, such as, graphics, pictures, writing and sound process. Therefore, information and communication technology in contemporary times, complement and aid each other in facilitating effectiveness and efficiency in executing life tasks, vocational tasks and problem solving, establishing and sustaining social relationships, increase productivity and general growth of the population, whether in global literacy, workforce training and community development process. It is pertinent to note that the same way ICT has evolved to provide support to human development and industrial growth of nations, so it has also contributed to the educational development and literacy growth of people of developed and developing nations, including Nigeria. This paper seeks to empirically investigate the extent of deployment of sustainable ICT infrastructure in Nigeria in order to ascertain its impact on the development of the nation in general.

Participating in the information society is however contingent upon access to information infrastructure. Infrastructure generally refers to the basic installations and facilities on which the continuance and growth of a community or state depends. Social facilities like roads, railways, telecommunication networks, electricity supply system and water supply system are all described as infrastructure. Infrastructural facilities have supporting and enabling functions and are shared by a large community of users. Recently, the term has also been used along with information to denote the information resources, networks, computers, software, developers, and producers which support the creation, transport, storage and use of information. Information infrastructure denotes socio-technical systems composed of hardware, software, information content, human experts and network standards that facilitate information creation and exchange. Each of these elements constitutes a critical component which can be easily misused if not properly managed hence the need for information infrastructure policy.

2. Statement of Problem

There is no doubt that Information and Communication Technology plays a great role in the development of any nation and the general belief that Information is power is unarguable but if the ICT devices are unevenly distributed or if they are not available across the length and breadth of the affected nation, will these statements be relevant? This is why this paper seeks to investigate the extent to which a nation like Nigeria where majority live in the rural areas and a fast majority are digitally illiterate has deployed ICT infrastructure for national development. The paper will also look at the challenges facing the availability of these ICT infrastructures. Focussing on the critical sectors of any nation, this paper will give answers to the following questions.

1. To what extent has ICT infrastructure deployed to the education sector?

- 2. Has Agricultural sector felt the impact of ICT infrastructure?
- 3. What about Trade and Investment?
- 4. To what extent has affected the social infrastructure such as road, water, power etc?
- 5. What is the impact of deployment of ICT Infrastructure on Health sector

3. Literature Review

3.1. Introduction

Prior to 1999, development in the ICT sector of Nigeria was far below expectation for a country of its size and resources. For example, total fixed telephone lines were less than 400,000 while regular internet users were less than 200,000 (National ICT Policy 2012). From a policy and regulatory standpoint, the Federal Government of Nigeria adopted the National Telecommunications Policy (NTP) in 2000 to guide the development of the telecommunications industry in Nigeria. This was followed by the enactment of the Nigerian Communications Act (NCA) 2003 to give legal effect to the NTP. Previously, the National Mass Communications Policy recommended the creation of a regulatory body to regulate Broadcasting and this led to the promulgation of Decree 38 of 1992 that established the National Broadcasting Commission (NBC). In a similar vein, the National Information Technology Policy was approved in 2000 to guide the IT industry in Nigeria, and was followed by the enactment of the National Information Technology Development Agency Act 2007 which became the legal platform for the creation of NITDA. It is noteworthy that there has never been a national postal policy, however, Decree No. 41 of 1992 established the Nigeria Postal Service (NIPOST) to provide postal services in Nigeria. This literature review will be centred on the research questions highlighted above.

3.2. Education

A review of 219 studies on the use of technology in education consistently found that students in technology rich environments experienced positive effects on performance in all subject areas (Look, 2005). In particular, Becta (2003) pointed out that ICT provide fast and accurate feedback to students, up computations and graphing, thus freeing students to focus on strategies and interpretation. Further, use of interactive multimedia software, for example, motivates students and leads to improved performance. In fact, studies showed that more students finished high school and many more consider attending college where they routinely learned and studied with technology (Becta, 2003). Barak (2004) pointed further that the use of ICTs in education would promote deep learning, and allows schools to respond better to the varying needs of the students.

3.3. Agriculture

Most African economies are dominated by agriculture,

which contributes about 17% to the Gross Domestic Product (GDP), 40% of exports, employment creation and has the potential to reduce poverty. The agricultural sector has been described as the engine for economic growth and improved livelihoods in Africa (World Bank 2006; Diao et al., 2007).

The majority of the population in Sub-Saharan Africa lives in rural areas and depends directly or indirectly on agriculture (Diao et al., 2007). Despite the great potential for agricultural production in Africa, about 73% of the poor people living in rural areas subsist on less than a dollar a day (UNDP, 2005). About 200 million of the world's hungry people are found in the continent (Millennium Development Goals (MDGs) Technical Support Centre 2004) and available statistics suggest that about one third of Africa's population is malnourished (UNDP 2005). Africa has the highest proportion of people living in extreme poverty in the world. Africa is the only continent where food production has been falling over the years. Available statistics suggest that about 26% of Africa's population is malnourished. There has been under investment in the rural areas; inadequate access to markets and unfair market conditions; inadequate access to advanced technologies; weak infrastructure, high production and transport costs, conflicts, HIV/AIDS, natural disasters, deforestation, environmental degradation, loss of biodiversity and dependency on foreign aid. The number of people living below the poverty line in Sub-Saharan Africa (SSA) is over 180 million, and is expected to exceed 300 million people by the year 2020. In addition, the per capita food production has continued to decline in SSA. It has been pointed out that the key to reversing this trend is to develop agriculture and industry through science, technology and innovation (ECA 2005). There is a general lack of accurate information on prices and markets for agricultural products (IICD 2006).

3.4. Business

The role of ICTs in business and commerce cannot be overemphasised. ICTs encourage international business among other things. It was in this regard that Souter (1999) wrote that international companies will choose to locate facilities in countries which most effectively provide the reliable communication links that are essential to their global business interest and bypass countries that do not. ICTs have brought about what is called "online banking", that is, banking electronically through the Internet and Automated Teller Machine (ATM). This is one of the greatest developments in the business and commerce field. Online banking reduces the stress that was once associated with the banking sector. ICTs have also led to electronic commerce (ecommerce) - buying and selling electronically. Akpan (2004) noted that ICTs create exiting commercials or advertisement on television.

3.5. Health

Akpan (1991) gave an instance when he said that "the stethoscope is one of the most powerful communication symbols used by doctors, unless the doctor uses it in many

situations, people will not have the feelings that they have been examined by the doctor. The stethoscope can contribute to the effectiveness of the doctor's message

4. Level of ICT Deployment in Nigeria

A Ministry of Communication Technology was created a couple of years ago and the following Agencies have been brought under its purview: NCC, NITDA, and NIPOST. Two Limited Liability Companies wholly owned by government; NigComSat and Galaxy Backbone have also been brought under the Ministry (National ICT Policy, 2012)

The government, through National Information Technology Development Agency (NITDA) has made frantic efforts to establish and develop a National Information Infrastructure (NII) 'backbone' as the gateway to the Global Information Infrastructure (GII) interconnecting it with State Information Infrastructure (SII) and the Local Information Infrastructure (LII). It is quite unfortunate that a leadership direction and vision to guide IT infrastructure development has not been provided. There is no equitable access to all users and stakeholders and there is no guarantee for a private, faithful, accurate, confidential, secure, available and quality of personal information.

4.1. The Role of NigComSat Includes

i. To manage and exploit the commercial viability of the Nigerian Communications Satellite for the socioeconomic benefit of the nation. If the NigComSat functions at its best, it will aid national development.

4.2. The Roles of Galaxy Backbone Includes

- i. Providing ICT infrastructure, applications and services to all FG MDAs and institutions e.g. manage Government Data centres, and databases, Directory
- ii. Services, National information repositories, IP, telephony and other solutions; including but not limited to services delivered on the shared platform providing technical support to the Ministry of Communication Technology for end to end Quality Assurance of ICT projects and capacity building for ICT professionals in Government

5. Prospect of ICT Infrastructural Development in Nigeria

ICT is a unique tool capable of encouraging sustainable economic and social development in the society. Effective integration of ICT into a programme that envisions community or citizen participation and information sharing, becomes an enabling forces for sustainable societal development. The field of "communication for development" possesses a long legacy of the critical and effective application of technologies, particularly information and communication technologies, for development. Whether the developing countries like it or not, the new IC T tools are rapidly finding their ways into different sectors of the society and thus creating a global village.

Conventional wisdom holds that the application of information and communication technologies is a good drive both in rural and urban areas towards economic, social and cultural development. The potentials of ICT application can be viewed from the common terminologies that are used in almost every sector in the society. For instance, telemedicine, e-learning, tele-commuting, e-banking, are ICT applications that make it ultimately possible for developing countries, Nigeria in particular to improve the quality of living, especially in the rural and remote areas. Thus, ICT application is a silent and a bitter truth for safety, security and governance.

Report by Nigerian Communications Commission (NCC) showed that the total tele-density was 0.4 lines per 100 inhabitants in 1999; reached 1.96 in Dec 2002. It increased to 3.33 in December 2003. By March 2004, the total tele-density was estimated at 3.92 lines per 100 inhabitants. By July 2011, the total tele-density rose to 60; this was unprecedented. This growth was the result of continued uptake of digital mobile services (with about 98% market share) and the adoption of a Unified Licensing Regime.

Another giant stride that has been recorded in Nigeria in the ICT sector is that the Communications sector has actively contributed to Gross Domestic Product (GDP). The percentage share of GDP from Communications, according to NCC rose from 0.06 in 1999 to 2.39 in 2007, 2.90 in 2008 and 3.66 in 2009. Private investment in the telecoms subsector rose from US\$50 million in the year 1999 to over US\$18.0 billion at the end of 2009

Policy and regulatory developments along with other government and private sector initiatives have resulted in significant improvement of the ICT sector. For instance, Nigeria has moved from approximately 400,000 available fixed telephone lines pre-1999 to over 90.5 million available mobile telephone lines by the first quarter of 2011 this is expected to have risen to about 140,000,000 by the end of 2014, thereby making Nigeria's telecommunications market the fastest growing in Africa. There is now modest ICT deployment in the functioning of government organizations, as well as in the private sector.

In addition, ICT now drives some activities in the financial and oil and gas sectors while various e-Government initiatives are ongoing in various departments at the three tiers of government.

Some of the achievements in the telecom sector have been supported by extensive optical fibre projects across the country, as well as, deployment of satellite communications infrastructure. The NCC initiated the establishment of Internet Exchange Points (IXPs), the Wire Nigeria Project (WIN) and the States Accelerated Broadband Initiative (SABI).

6. Impact of ICT Infrastructure on Critical Sectors of Nigerian Economy

Various sectors are critical to and contribute to national development; these sectors include Education, Agriculture, Health, Social, Entertainment, Legal system, Commerce and Industry, Governance and host of others. It has been established that these sectors will function optimally when they are backed by functional ICT infrastructure. Lets us consider the role played by ICT devices on these sectors.

6.1. Education

Education as defined by Wilson (2005) is the social and technical transmission of knowledge from one generation to another, through formal and informal media of communication. Olise (2008) added that education is the direct means by which one sharpens his or her destiny in order to transform what one knows him/her to be into what he/she hopes to become.

Education is an important component in the life of every individual in every society and it is an essential component of sustainable development. Tiamiyu (2002) noted that literacy, education and skills development of citizens would increase the capacity for informal education of personal and social choices for gainful and sustained employment and for effective participation in governance. Essentially, with active deployment of ICTs in Africa, the people can be enlightened on the role of education for both human and sustainable development. Anaekwe (2008) posited that the application of computers in education has given rise to computer assisted instruction. computer programming instruction, and individual instruction among others. These programmes, he remarked further, are usually designed to facilitate self teaching using the computer.

Furthermore, the introduction of ICTs in education has led to the computerisation of traditional learning materials like books, journals, newspaper, newsmagazines in the library. This is what is generally referred to as "virtual library".

That we have white chalk boards and electronic board which have eased the learning process simply means that ICTs are significant tools for developing every aspect of the society. In addition, man can be educated without attending a 'four corner physical structure', regardless of geographical location through distance learning and electronic education which are indications that with ICTs, human development can be sustained.

6.2. Agriculture

Economic and social historians have argued that most developing countries especially those of African countries, most importantly Nigeria have not experienced the agricultural nor industrial revolution like the developed countries (Tiamiayu 2002). However, with ICTs, the windows of awareness for agricultural revolution in Africa are now opened. Imoh (2007) stated that for the past 50 years, development planners have used communication to support and promote agricultural development policies and programmes in a wide range of settings and condition with relative success. No doubt, ICTs can be used to sustain such success, and even improve on it.

ICTs can be used to give farmers access to information about plants and animals requirement and disease thereby improving productivity (Souter 1999). This becomes imperative because as noted by Mojisola (2007) achieving rural and agricultural development is a function of producing knowledgeable and well-informed farming communities. This can be achieved with ICTs without much stress, because of the flexibility and portability of some of them such as the mobile phones. This is what informed the distribution of mobile phones to the Nigerian farmers by the present federal government.

6.3. Health

Any development agenda that does not include health care and health delivery system is no development. Child health, maternal health, disease prevention, etc., should be a primary concern in Africa, if the current development strides are to be sustained.

ICTs have the potentials to remove resistance to innovations of developmental nature as they relate to health. For example, by using satellite controlled computers and other technological devices to let a patient appreciate the risk inherent in the fibroid that is not removed on time, would boost and sustain the confidence of the patient on health services delivered. Akpan (1991) gave another instance when he said that "the stethoscope is one of the most powerful communication symbol used by doctors, unless the doctor uses it in many situations, people will not have the feelings that they have been examined by the doctor. The stethoscope can contribute to the effectiveness of the doctor message".

Furthermore, ICTs can contribute to the checkmating of some deadly diseases like HIV/ AIDs, diabetes, cancer, Alzheimer, etc. ICTs have enabled medical staffs who are desirous of updating their knowledge to be Internet friendly so as to know the latest trend in their discipline.

Above all, ICTs have and are still helping to improve the fields of healthcare and health delivery.

6.4. Business and Commerce

The role of ICTs in business and commerce cannot be overemphasised. ICTs encourage international business among other things. It was in this regard that Souter (1999) wrote that international companies will choose to locate facilities in countries which most effectively provide the reliable communication links that are essential to their global business interest and bypass countries that do not.

ICTs have brought about what is called "online banking", that is banking electronically through the Internet and Automated Teller Machine (ATM). This is one of the greatest developments in the business and commerce field.

Online banking reduces the stress that was once associated

with the banking sector. ICTs have also led to electronic commerce (e-commerce) buying and selling electronically. Akpan (2004) noted that ICTs create exiting commercials or advertisement on television.

Information and Communication Technology (ICT) offers another wonderful opportunity as it is an essential part of national infrastructure and factors greatly in both public and private sector business enterprises. It creates business opportunities, especially for companies located far from urban centres, and improves links among firms, suppliers and clients. When used well, ICT can also make management and operation more efficient.

In another development, Sangowusi cited by Attama and Owolabi (2008) maintains that ICT is very useful in corporate environment because it promotes performance and improves efficiency.

6.5. Legal System

Globalization driven by ICT is having a phenomenal impact on acquisition of legal, and other relevant learning, teaching and research materials in law libraries across the country. Through ICT, lawyers and students can have access to current court proceedings/cases and law reports anywhere, any time and in any form in the country.

There is no doubt that the integration of ICT into the practice of law is of much benefit to the profession in Nigeria in the 21st century. ICT is a remarkable tool for providing comprehensive, current and timely legal services to the citizenry. (Okon and Bassey, 2008). The relevance of ICT adoption and utilization in Nigerian legal system for effective and efficient service delivery is a contributory factor to sustainable development in Nigeria.

6.6. Electronic Government

Electronic Government popularly regarded as E-Government has been defined as 'the government owned or operated systems of information and communication technologies that transforms relation with citizens, the private sector and/or other government agencies so as to promote citizens' empowerment, improve service delivery, strengthen accountability, increase transparency or improve government efficiency' (World Bank, 2001). Akunyili (2010) described it as the use of information and communication technology to enhance access to government services for the benefit of all. E- Government might involve delivering services via the Internet, telephone, community centres, mobile devices, wireless applications or other communications systems. E-Governance is a related term that is often used interchangeably with e- government. Otubu (2009) however argues that e- governance is a broader concept that encompasses all interactions and exchanges between the government and the governed and includes e - voting, edemocracy and e- representation whereas, e - government relates to the use of ICTs to transform and support government services to the citizens resulting in ICT based services such as e - tax, e -transportation or e- health.

7. Challenges Facing the Deployment of ICT Infrastructure in Nigeria

The development and deployment of ICTs have brought about phenomenal improvements and great opportunities for developing countries to participate meaningfully in the global digital economy. Therefore, the need for Nigeria to harness existing ICT tools to enhance sustainable socio-economic development cannot be over-emphasized.

It must however be noted that numerous challenges which include lack of a comprehensive and harmonized ICT policy, inadequate infrastructure, legal and regulatory framework, Universal Access/Service, Security and Local content, etc. must be addressed for the country to meaningfully participate in the information age.

i. Policy, Legal and Regulatory Framework

Presently in Nigeria, Policies guiding the ICT sector are treated under various legislations.

These laws are however not comprehensive enough to deal with convergence and other ICT related issues in the current digital world.

ii. ICT Infrastructure

The paucity of ICT infrastructure in the country has greatly hindered the provision of efficient and affordable ICT services to the citizens.

iii. Internet and Broadband

Internet and Broadband have been globally acknowledged as the foundation for transformation to the knowledge economy. Broadband has the potential of enabling entire new industries and changing how we educate our children, deliver health care, manage energy, ensure public safety, engage government, and access, organize and disseminate knowledge.

iv. Capacity Building

Despite the proliferation of ICT training institutions in the country, proficiency in ICT is still very low among the populace.

v. Universal Access

Over 70% of Nigerians reside in the rural areas and most do not have access to advanced ICT services. In addition, some Nigerians reside in urban areas that are unserved or underserved.

vi. Public Private Partnerships (PPP)

Private sector participation has been identified as a major catalyst in ICT development across the globe. However, Nigeria is yet to take full advantage of the enormous potentials inherent in public-private-partnership in ICT development.

vii. Local Content Development

ICT local content (including software and hardware) is grossly underdeveloped in Nigeria.

This has resulted in over-dependence on the foreign importation of software and hardware and diminished opportunity for capacity building in ICT content creation. In addition there has been the related drain on the Nigeria's foreign exchange.

viii. Security

Major challenges facing the country in the area of ICT development include cybercrime.

Fighting cybercrime requires appropriate legislation and a high degree of coordination between ICT related agencies and security organizations.

8. The way Forward

- Nigeria must continue to encourage private investment through the implementation of progressive sector policies such as the ICT sector
- An initiative code-named *the WiN Project* or Wire Nigeria Project, which aims at ensuring that all the States of the federation are linked to a national optic fibre cable backbone infrastructure should be launched

Apart from the above requirements, there must be the following:

- Reliable Electric Power supply
- Reliable Database for names and addresses
- Effective and reliable law enforcement agencies
- Competent Judicial systems
- Strong financial regulatory regime
- Trained Manpower

9. Conclusion

Nigeria requires solid ICT infrastructure to be able to harness the full benefits of the information age and become an active member of the global digital economy.

With proper and effective deployment of ICT devices a lot of gains would be accrued to the nation because the country would have positively responded to the emerging global reality and thus avert becoming a victim of the digital divide.

Recommendation

A developing nation like Nigeria that aspires to participate effectively and become a key player in the emerging Information Age needs to have in place, a highly efficient Information Technology system driven by a vibrant national IT policy.

Attention should be given to developing globally competitive indigenous human capital and Knowledge based Products and Services in targeted areas of ICT (software, hardware, networks, card technologies, security/biometrics, web and digital content development, etc)

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