

INFORMATION COMMUNICATIONS TECHNOLOGIES FOR SUSTAINABLE DEVELOPMENT IN NIGERIA – A REVIEW

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ABSTRACT

Most African countries, including Nigeria, are not on course to realize the millennium development goals (MDGs) by 2015. Poverty level towers higher, as well as income inequality. This is not the case in the “information-rich” developed countries, where socio-economic sustainable development is powered by information communications technologies (ICTs). This paper argues that ICTs will provide the targeted tools for and facilitate sustainable development in Nigeria, if adopted faster than the progression shown for earlier technologies.

INTRODUCTION

The report released by the Organisation for Economic Co-operation and Development^[1] up to 2000 (the end of 20th Century) show that the gap between developed and developing nations is widening due to “digital divide” or simply connectivity to the Internet. The developing countries need to achieve a “leapfrog” development to catch up with world prosperity.

Over the past 20 years, China has successfully achieved rapid economic growth by attaining the goal of quadrupling its GDP from the 1980 level. However, the first leap in China’s modernization caused the problems of environmental pollution and land degradation. Such progress with focus only on economic targets is unsustainable. To reach the goal of harmonious economic, societal and environmental advancement, development must be managed by a comprehensive approach, called sustainable development^[1].

Information communications technologies provide the tool needed to achieve sustainable development in Nigeria. We live in a world divided between rich and poor, healthy and sick, literate and ignorant, democratic and authoritarian, and between empowered and

deprived. All traditional technologies as well as those adopted, in combination with all the policies enacted, for enhancing human development over the past centuries have not wiped these glaring disparities^[1].

Development indices are depressing. More than 2 million people die of tuberculosis annually. Life expectancy in Sierra Leone is 37, a level not seen for centuries in the West. Dismal development statistics have abated the categorization of countries into developing nations, emerging economies, economies in transition, etc. “Digital divide” describes the gap between countries (and groups within countries) in terms of their or capacity to harness the power of information communications technologies (ICTs)^[1].

In September 2000, the 189 member countries of the United Nations adopted eight Millennium Development Goals (MDGs), which committed them to making substantial progress toward the eradication of poverty and achieving other human development goals by 2015. The MDGs acknowledge the multidimensional nature of development and poverty alleviation. An end to poverty requires

more than just increasing incomes of the poor^[2]. The eight goals are ambitious: to eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality and empower women; reduce child mortality; improve maternal health; combat HIV/AIDS, malaria, and other diseases; ensure environmental sustainability; and develop a global partnership for development.^[3] The goals are then assigned specific targets deemed achievable by 2015 based on the pace of past international development achievements.

The Johannesburg World Summit on Sustainable Development of 2002 demonstrated a more extensive scope and included many areas of deprivation and action points. For instance, the 19th article states^[4]:

We reaffirm our pledges to place particular focus on, and give priority attention to, the fight against worldwide conditions that pose severe threats to sustainable development of our people, which include chronic hunger, malnutrition, foreign occupation, armed conflict; trafficking in persons; terrorism; intolerance and

incitement to racial, ethnic, religious and other hatreds; xenophobia; and endemic, communicable and chronic diseases, in particular HIV/AIDS, malaria and tuberculosis.

The summit also underlined the importance of technology for development, such as cost-effective desalination of seawater, recycling and renewable energy resources, diversification of energy supplies, advanced energy technologies and even phasing out subsidies. There was an explicit reference to information communications technologies (ICTs) for development in Johannesburg. The importance of ICTs culminated in the World Summit on the Information Society (WSIS), phase 1 held in Geneva in December, 2003^[2].

ICTs drive development in the “information-rich” developed countries, unlike the “information-poor” developing countries which lag behind in development. This paper argues that ICTS will provide the targeted tools for and facilitate sustainable development in Nigeria, and recommends that it be adopted faster than the progression shown for earlier technologies.

LITERATURE REVIEW

The International Telecommunications Union (ITU) estimated the worldwide ICTs market in 2002 as \$21 trillion, and segmented it as Telecom Services (39%), Software and services (31%), and Hardware (30%). This comes to nearly 6.6% of Gross World Product.

Surprisingly, in developing countries, ICTs can be considered to be built on 4C's, namely, computing, communications, content, and (the often overlooked) human capacity. The recent World Summit on the Information Society (WSIS) focused extensively on 3C's, to wit, communications, content and capacity building, and less on computers. In truth, computing and other hardware continue to

become less and less expensive, especially on a price performance basis. When considering the use of ICTs for development, conventional wisdom is that even if hardware is free (e.g. donated), communications, software, and training make ICTs expensive.^[5]

ICTs are more than computers and telephony. Rather, ICTs are embedded in virtually all industrial, commercial, and services systems. Applications of ICTs can be divided under two broad categories. The first are those largely dependent on traditional telecommunications networks (including the internet) that enable on demand communications to provide or process

information. Whether the information is used at all or/and transformed into knowledge is left to the human user who asked for it in the first place^[5].

The second group of ICT applications, for want of a more appropriate name, we shall call Human independent, where information is processed and decisions are arrived at on the basis of preset criteria without human intervention at the time of decision making. These can be nearly passive systems, or part of a larger system (embedded ICTs). Examples include sensor based networks that determine automated climate control for buildings and sensor networks for malaria larvae dictation (today, or, in the near future). Many of the more discussed applications of ICTs for sustainable development are of the first category, ranging from distance education programmes, e-commerce or e-governance, while the second class of applications remains largely unrealized^[6].

A few technologies can be classified as all-purpose technologies as their innovations extend over many areas, and these, in turn become indispensable elements in society's portfolio of development. Over a period, their contributions to economic and human development become impressively large, replacing older and less efficient methods. Their ubiquity makes one wonder how it was possible to manage in the past without accessing such technologies^[6].

Electricity is often cited as a typical example of an all-purpose technology. In spite of electricity's obvious advantages, it took almost a century before electric power could become commonplace. Applications from new technologies are faster these days. The diffusion of radio and television was faster than electricity, and that of the internet is spectacular. Within 35 years of its existence, the internet has more than one billion users and its performance has multiplied manifold. Yet, the World Wide Web, practically speaking, is scarcely a decade old. The rapid diffusion of the internet and new communications

technologies, such as mobile telephony, suggests that innovations from ICTs for sustainable development can also be faster than the progression shown by earlier technologies. This may provide society with targeted tools for sustainable development programmes^[6].

The World Commission on Environment and Development (Brundtland Commission) defined sustainable development as meeting the needs of current generations without compromising the ability of future generations to meet theirs^[7]. The debates of the Millennium Summit upheld this definition.^[8] Hughes and Johnston^[9] recognize that sustainable development is now as much about efficient resource-use and conservation of natural resources for future ones.

Sustainable development stands on three pillars in terms of its definition for the 2002 World Summit on Sustainable Development (WSSD). These are social development, economic development and environmental protection. In 1972, the first World United Nations Conference on Human Environment took place in Stockholm, Sweden, consequent upon the recognition of environmental problems as a global issue. Hence, sustained growth is the key to greater social equity. What is needed is economic growth that does not leave large segments of humanity behind. Non-inflationary growth of about 2-3% per year in OECD countries is needed to maintain high levels of employment. To enable substantial convergence with the development countries, most developing countries will need to sustain GDP growth of 6-8% per year over the next 3-4 decades. China has succeeded in this since 1990, and India is now getting on track^[10].

In Nigeria, ICTs aim to develop understanding of how ICTs innovation is associated with change in society. ICTs influence the shaping of socially responsible and ethical policies and professional practices. ICTs impact changes in particular domains of human activities, including work, the home and private life and governance. Ethical, political,

economic and cultural dimensions of ICTs innovations help in development. ICTs facilitate the study and reporting on how computers have affected employment levels, job content and structure, working conditions, career patterns and participation. They also facilitate addressing problems relating to computers and work and proposed measures for dealing with these problems. They encourage and support the design and development of systems which promote not only efficiency but provide job satisfaction, for example through interesting work and reduction of stress. ICTs also provide an international forum for assessing the social consequences of their ubiquitous presence and applications^[11].

ICTs for sustainable development promote the safe and socially beneficial development and contribute to the development of an information society that meets the human needs of the present without compromising the ability of future generations to meet their own needs. Access to the right data at the right time, which can lead to good decision making that may translate to good governance, could be offered with ICTs in Nigeria.^[11] They are involved in the development applications which involve the goals of sustainable development and equally help investigate the interaction among social, environmental and economic issues in their development and applications. They promote worldwide research and practice for their further advancement towards a safe and sustainable self-developing world. ICTs provide a platform for presenting and discussing ideas and trends in the intersection of the topics, “information society” and “sustainable development”.

Notwithstanding the excellent aims and functions of ICTs, there are challenges. The simplified mode of ICTs masks the challenges that require extensive research, both in technology and in the social sciences. There are issues that determine the viability of ICTs for sustainable development, primarily focused on traditional computing and connectivity. Some of these are common to the needs of

developed countries, which often have institutions and mechanisms to address some of them^[12].

The digital divide is actually a manifestation of other underlying divides, spanning from economic, social, geographical, gender, and other divides.^[13] Awareness, availability, accessibility and affordability are the features that determine the value of ICTs for a user. People must know what can be done with ICTs, and must also be open to using ICTs. Availability of ICTs facilities must be within reasonable proximity, with appropriate hardware/software. Accessibility relates to the ability to use the ICTs. Affordability of ICTs should ideally be only a few per cent of one's income. This covers life cycle cost, spanning hardware, software, connectivity and education^[14].

Reducing the divide requires improvements across all the dimensions of ICT: computing, connectivity, content and human capacity. Personal computers (PCs) are prohibitively expensive for most people, making shared access (e.g. community centres or cybercafés) inevitable. PCs today are very difficult to use and even “experts” spend a lot of time maintaining their machines, worry about upgrades, security, compatibility of hardware, etc.^[14]

While mobile telephony is improving worldwide, it remains expensive, limited in rural areas and poor at providing data connectivity. Meaningful content is lacking in many languages, and most content is not occasionally relevant. Today's systems tend to make people passive consumers of information, instead of enabling generation of information. Users need to be aware, literate and innovative to harness the power of ICTs. They also should be empowered to use ICTs, as both society and state. ICTs usage does not occur in a vacuum, rather within social and cultural norms. It is based on policy and business modes, especially regulatory in the long run. It must provide value and be sustainable from both user and provider perspectives. Affordability is a

limiting factor, since we have seen that many people could avail of ICTs, but do not. Access is a severe bottleneck for increased ICTs use for many human development projects^[11].

The history of the Internet sheds some light regarding the problems faced by users, both in developing as well as developed countries. Technologically, the Internet was built to be “best-effort” and security, quality of services, etc, have been continual add-ons. It was built for simpler uses and assumed literacy, affluence, and trust amongst end-users. Today, the move is to run everything over the internet, including critical applications, such as voice, video and even mission. Internet governance and protocols both need to be enhanced to expand its ubiquity and inclusiveness^[14].

Availability of electricity is a critical pre-requisite for ICTs. The alternative of standby generators is very expensive. The need

for low power consumption becomes critical when we consider ICTs devices that are not computers, such as mobile devices or sensors that can be minuscule. Until technology improves to reduce power consumption, the size and cost of these devices will remain high, and their penetration low. In the era of Internet, broadcasting technologies are often ignored.^[15] Over the air broadcasting is an extremely cost-effective method of unidirectional imparting of information, e.g. through television (TV) or radio. Digital information can be broadcast easily, and there is already widespread usage of digital TV and, now, digital radio. These technologies can carry data signals for various end-use devices, ranging from computers to specialize but less expensive receivers that could receive data on say weather, agricultural prices etc.

ICT AND DEVELOPMENT

ICTs are viewed as both a means and an end for development. With roughly two-thirds of world economy based on services, and the rise of India, Philippines, and other nations as global ICTs players, many developing countries have accepted ICTs as a national mission. Even within manufacturing and industry, ICTs have an increasingly important role to play. During 1995-2002, when the US economy posted impressive overall growth, nearly one-third of the growth in productivity was attributable to ICTs. While the growth rates of ICTs, even in developing countries, are impressive, the base upon which these apply is very low^[16].

ICTs can help achieve the MDGs by increasing efficiency, transparency, and competitiveness; opening up new opportunities and business models; and empowering citizens. The role of ICTs in the MDGs could be seen in each of the MDGs. By increasing access to market information; reducing transaction costs for poor farmers and traders; increasing efficiency, competitiveness and market access

of developing countries to participate in global economy and to exploit comparative advantage in factor costs (particularly skilled labour), ICTs facilitate the realisation of MDG 1, which seeks to eradicate extreme poverty and hunger; halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day; and halve between 1990 and 2015, the proportion of people who suffer from hunger^[16].

MDG 2 seeks to achieve universal primary education; ensure that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. ICTs could increase supply of trained teachers through ICTs-enhanced networks that link teachers to their colleagues, improve the efficiency and effectiveness of education ministries and related bodies through strategic application of technologies and ICTs-enabled skill development. Also, ICTs broaden availability of quality educational materials/resources^[16].

MDG 3 seeks to promote gender equality and empower women. Using appropriate technologies, ICTs could deliver educational and literacy programmes specifically targeted to poor girls and women. ICTs influence public opinion on gender equality through information or communication programmes using a range of ICTs^[16].

MDG 4 seeks to reduce child mortality. MDG 5 seeks to improve maternal health. MDG 6 seeks to combat HIV/AIDS, malaria, and other diseases; reduce infant and child mortality rates by two-thirds between 1990 and 2015; reduce maternal mortality rates by three-quarters between 1990 and 2015; and to provide access to all who need reproductive health services by 2015. These could be achieved by enhancing delivery of basic and in-service training for health workers, increased monitoring and information sharing on disease and famine, increased access of rural caregivers to specialist support and remote diagnosis, increased access to reproductive health information, including information on AIDS prevention, through locally appropriate content in local languages. All these roles are played by ICTs^[16].

MDG 7 seeks to ensure environmental sustainability; implement national strategies for sustainable development by 2005 so as to reverse the loss of environmental resources by 2015; halve by 2015, the proportion of people without sustainable access to safe drinking water; and achieve by 2020 a significant improvement in the lives of at least 100 million slum dwellers. ICTs could promote these through remote sensing technologies. Communications networks permit more

effective monitoring resource management mitigation of environmental risks. ICTs increase access to and awareness of sustainable development strategies, in areas such as agriculture, sanitation and water management, mining, etc. Greater transparency and monitoring of environmental abuses, enforcement of environmental regulations, and knowledge exchange and networking among policymakers, practitioners and advocacy groups could be facilitated by ICTs^[17].

ICTs have not reached all the nooks and crannies in Nigeria to effect development. The country is still having energy crisis. There is no ICTs operation that will not require electricity. Since there is inadequate power supply in Nigeria, operating most of the ICTs facilities is not making progress as planned. Acquiring the Western technologies is important to the country, but managing the technologies is very difficult for the level of development that exists in Nigeria. Many children are still out of school because their parents could not afford the basic primary school fees. There are many street beggars today because they are hungry. The number of people with malnutrition is still very high. Children and mothers are still seen in unhealthy conditions in the rural areas. There are still unsafe drinking waters for most of the citizens in Nigeria. The number of unemployed graduates is enormous in Nigeria. Although ICTs have created employment for some youth who could get sponsors, many of them still find it very difficult to establish some kind of employment with ICTs. This is because ICTs business operation involves some financial backup^[17].

IMPERATIVES FOR ICT TO DRIVE SUSTAINABLE DEVELOPMENT

Certain imperatives must be put in place for ICTs to drive sustainable development. ICTs must improve across the 4C's dimensions. ICTs are more than computers, and the various thematic areas of sustainable development require innovations in hardware and software

for applications, such as sensors, controls systems, etc. Computers and other devices must become affordable^[18], and rugged for use without extensive maintenance, security efforts or other specialized skills. They must become easier to use with interface in all local

languages, and even in non-text interfaces (pictorial and spoken).

Typically, rural areas in developing countries, such as Nigeria, are without ICTs connectivity, let alone broadband (data) connectivity, at affordable prices - no thanks to the "digital divide". Universal access requires new networking and business models, perhaps combining public and private partnerships. ICTs are more than connecting to the internet. Human development programmes require integration of all forms of ICTs and media, such as mobile telephony, TV, radio, etc., as well as interconnecting systems, such as sensors, controllers, etc.^[18]

ICTs in sustainable development must provide relevant content (value) to end-users in local specifics. One requirement is for tools to make it easier for people to become producers of content and information, instead of just consumers. However, we would like to achieve the Information Bill of Rights: Getting the right information to the right people in the right timeframe in the right language in the right level of detail^[19].

Most people lack an awareness of the potential of ICTs. Beyond technical barriers, many limitations to incorporating ICTs are social, cultural or economic. A first goal for governments must be to increase literacy amongst its populace, especially for the historically disadvantaged, such as women. Often the success of development projects is driven by complementary (non-ICTs) institution building, such as the development of appropriate regulations, legal framework, and supply-chains^[19].

To be meaningful, ICTs need to be integrated into development as well as engineering and societal systems.^[7] More so, proponents or developers place too much focus on raw ICT (or even just connectivity), instead of optimally delivering value and services. Active efforts must be undertaken for global inclusiveness. Without concerted effort, ICTs, like many interventions or projects, would exacerbate existing divides, rather than

facilitate sustainable development^[20]. Solutions must be locally adapted, and extended into rural and other underserved areas.

A solution might appear beneficial at a pilot or small scale, but replication may pose enormous challenges. ICTs for Sustainable development (SD) must be economical, viable and provide value for end-users. They cannot thrive as charity, will become sustainable only when values are delivered. This is not to say that governmental interventions or subsidies have no role, especially during the initial stages. But, markets alone will not drive penetration into underdeveloped regions. The challenges are costly and long-term research and development required to make solutions viable. ICTs for SD research must be participatory and collaborative for the solutions to be globally relevant and sustainable^[21]. Development is vast, and no single or group of developers can solve all the challenges. This requires collaboration, sharing experiences, and scaling the programs to make them relevant. Many groups or even smaller countries lack the critical mass for them to undertake the full spectrum of effort required. All stake holders, including beneficiaries and end users, must have a voice in assessing its needs, responsibilities and measures of success.

ICTs for SD must become a recognized and funded enterprise. All the stakeholders must come together and increase their interactions, recognizing that ICTs for SD is an interdisciplinary field requiring technologists, social scientists, and development professionals working together.^[22] Even within traditional disciplines, ICTs for SD must become incorporated into Research and Development (R&D) and deployment projects. In the medium and long term, ICTs for SD should be categorized as a distinct field with its own defined challenges, support structures, professional societies, peer recognition, etc. Develop metrics for success and efficacy, and introduce academic rigour, cognisant of the fact that ICTs for SD is a nascent field, but attention

is often focused on isolated or niche success. Very few solutions have been impartially assessed as to their claims, and fewer have been verified as to their global validity or scalability. Funding, R&D, and implementation strategies require development of metrics for relevance, effectiveness, scalability and social sustainability^[23].

R&D should focus on real innovations and new challenges, instead of concerning itself with incremental changes to existing solutions, which are often touted as breakthroughs. The required innovations cannot be just technical, but also in business models and implementation strategies. It is important to identify at least a few “grand challenges” in ICTs that can lead to

radical innovations in sustainable development.^[24] R&D and technology development projects addressed specifically to meet the requirements of developing countries should not be left just to market forces, as these markets may not appear lucrative^[22]. To help balance technology-push and market-pull, R&D needs to be supplanted by an RD&D (research, development and development) paradigm, with real world deployments and test beds. Such new models development activities should take place in a network of centres and institutions, both in the developing and developed world with contributions from the governments and global organizations.

CONCLUSION AND RECOMMENDATIONS

Nigeria is battling with sustainable development challenges, including insufficient financial resources, lack of ICTs infrastructures, poor capacity building, and many others. ICTs drive sustainable development in developed countries, and could do so in Nigeria. Learning from the experiences of some countries, ICTs need to be adopted as the “leading goat” for sustainable development, the driving force for modernization of Nigerian economy and society. Nigeria needs to work together with other developed countries in order to exchange viewpoints of state policy on ICTs for sustainable development, bridge the “digital divide”, and to learn from developed countries in terms of their experience of the best practices, promoting south-south technical cooperation, such as training, case-studies and even trading of ICTs products. It is also the time for the United Nations to help Nigeria for a more equitable share for coordination, management and governance of using the Internet (for instance, the top domain names),

for regulatory frameworks, improving intellectual property rights and so on.

Coupling sustainable development with ICTs is the long term answer for development challenges. Therefore, it is recommended that:

- ICTs be used in the exact amount needed to make the quality of life better in Nigeria;
- ICTs must make use of energy and resource saving technologies;
- ICTs must enhance, or at least not impair, the physical, mental and social life of the humans;
- ICTs should assure education, creativity and the development of humans, preserve cultural and biological heritage; and
- There should be allowance for real-life interactive social activities among people, since a strong and reliable sustainable balance between the use of ICTs and our human/social activities is the key issue for a better life.

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