ICT and Sustainable Development in Nigeria

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Abstract: This study dealt on ICT and sustainable development in Nigeria, it has been observed globally that ICT is essential both to eradicate poverty and improving human capacity, ICT advances economic, social, cultural and political initiatives in ways that affect all stakeholders positively when done correctly. Therefore, it is the aim of this study to determine how ICT assist in sustainable development. This paper used the secondary method of data collection. Many literatures were reviewed. It was concluded that ICT can create cost competitiveness among nations. It helps to bring technology to remote areas where traditional technology would have been costly. It was therefore recommended that if Nigeria intends to meet up with sustainable development, it must encourage its citizens on the use of ICT to advance innovation and eco-friendly solutions to on-going problems.

Key words: Information, Communication, Technology, Sustainable and Development

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INTRODUCTION
1.1 BACKGROUND OF THE STUDY
One of the major challenges today in developing countries of which Nigeria is one is sustainable development. Government is faced with the challenge of transformation, a paradigm shift necessitated by the age of network intelligence. Internally, the government is called to improve the efficiency and effectiveness of internal functions and processes within government departments and institutions though internetworking while externally government are called to be more transparent and give citizens access to government information.

According to Ayodele (2007) sustainable development can be broadly defined as the ability of the economy to support the needs of the people of a country over a time, taking into consideration the economic, social and ecological constraints of the country. Amodu

(2008) states that sustainable development is a process rather than an end goal. He further noted that this process requires constant evaluation and analysis of the emerging trend in the discussion so as to take the issue of sustainable development to the next level. Sustainable development simply put is developing for the present and future, the process of ensuring that the present development is sustained and maintained or the future. Plans, projects and programmes have been formulated by successive governments in Nigeria to improve the lives of its citizens which are the main aim of development – empowering citizens not only for the present but for the future.

Information and Communication Technology (ICT) which include digital technologies like computers and the internet as well as radio and television have been touted as the potential tool for educational growth and sustainable development in Nigeria. Emenari (2004) noted that 'great transformations in the lives of the people are in part a function of advances in Information and Communication Technologies (ICTs)." Onwubualili (2004) added that "the magical changes are quite glaring in every facet of our lives and touches the simplest of domestic services to corporate and limitless industrial applications."

ICTs like the internet according to Nwanjika (2004) creates and meets demand which satisfies human and corporate needs. ICTs have been key enablers of globalization facilitating worldwide flow of information capital, ideas, people and products. They have transferred businesses, markets and organisations, revolutionized learning, empowered citizens and communities and created significant socio-economic growth in many countries. In recent years developing countries like Nigeria have started taking concrete actions to incorporate Information and Communication Technology into their economic policies and development agenda.

There are no doubt that information and Communication Technology has found its niche in every of Nigeria's Polity. When used appropriately ICTs can help Nigeria as a developing nation to access sustainable development. They are what are needed to climb the heights developed countries have reached. However, how developing nations such as Nigeria use ICT to derive sustainable development becomes pertinent and is therefore the focus of this paper.

Gilholly (2005) proffered that 'for ICT to positively foster development goals, it must be employed where relevant, appropriate and effective.'Heeks (2010) in addition opined that because of the speed at which digital technologies are changing the modus operandi of developing countries, and equally the rate at which development initiatives using ICT fails, enterprises and government alike should take the extra precaution to recognize that sustainable development is more than a mere transfer of technology from the North to the South. He posited that to the extent that sustainability is possible is to the degree that appropriate alignment between infrastructure and need meet. Otherwise, the only benefit will be wasted expenditures. We have seen dramatic technological advancement in the digital world, especially within the telecommunications sector. New entrants to the Nigerian market dominate the technology environment and are exceptionally profitable. In this new dispensation of globalization, we have seen a wave of enthusiasm and enormous contribution to poverty alleviation in countries such as India and China. Nevertheless, one ought to be careful in how one advances the development of ICT initiatives.

Singh (2011) opined that "ICT provides new opportunities for those who are literate, have a good education and adequate resources. Disadvantaged and marginalized

groups have little chance to benefit from tools such as the Internet automatically. This further increase social divides, widens the gap between rich and poor countries, regions, individuals and even between men and women". The challenge therefore becomes how countries and enterprises engage the use of ICT in strategic ways that advances 'economic, social, cultural, and political' endeavors for all its stakeholders in advancing sustainable development.

When one considers sustainable development in any realistic way, the balancing act lies between how individuals need are satisfied and how well one preserve the ecosystem and all natural resources. This is not necessarily an easy equilibrium to achieve. However, without it, sustainability may evade its implementers. We have seen tremendous advances in the role of e-government, for example, and the abilities it gives to citizens to be more productive. This initiative needs to continue by integrating services across departments and ministries. It is not simple to determine and master the complexities surrounding socio-environmental challenges but sustainability is impossible without such comprehension. Inas (2005) posited that any opportunity to effect sustainable development requires that new and efficient qualitative evaluation schemes coupled with "an integrated assessment of the ecological, social, and economic features and implications of a given project, technology or agro-ecosystem through the use of appropriate indicators" be executed. Sustainable development takes time but its benefits are materially rewarding. Sustainability also requires cooperative and collaborative endeavors that advance positive relationships between the various indices. One must therefore, be mindful not to confuse piecemeal approaches, such as sectoral management with sustainable development because although local zones can attempt to manage their own affairs, until there is a common purpose in recognizing a single solution for prevailing problems, the likelihood of problems recurring will hold strong possibilities.

The United Nations millennium development goals (MDG) hope to address the dysfunctional trend in human development within a relatively short period. Although achieving the MDG deadline might be optimistic - 2015, its eight objectives are essential to good governance for sustainable development. These goals are: (1) eradicating extreme poverty and hunger, (2) achieving universal primary education, (3) promoting gender equality and empowering women, (4) reducing child mortality, (5) improving maternal health, (6) combating HIV/AIDS, malaria and other diseases, (7) ensuring environmental sustainability, and (8) generating a global partnership for development. Although number seven is listed separately, the prevailing contemporary environment dictates that all eight shares a phenomenological umbilical relationship and ICT is fundamental to realizing such noble endeavors. More countries and enterprises are recognizing the importance of ICT to poverty alleviation. A poor woman farmer in a rural community can use a telephone to enquire about her vegetable prices without the overhead of a bus fare or the physical endurance such journey require. One will agree, however; that such possibilities arise out of the willingness to invest financial resources, ICT infrastructure, and capacity building.

2.1   CONCEPTUAL FRAMEWORK OF ICT

Gilholly (2005) argued that if countries want to tackle the MDG seriously, they must appropriately deploy, integrate, and prioritize ICT. The author noted that ICT is essential both to eradicating poverty and in creating sustainable human development. He conceded, however, that the paradox of "persistent scarcity in a digital era of superabundant capacity

– is perhaps the greatest single challenge to the networked economy and society." He further opined that because of the complex prevailing realities, grasping fulsome clarity is difficult to achieve. Nevertheless, Gilholly (2005) proffered that if ICT is situated appropriately, it can significantly aid the process of the MDG in relatively short periods thereby substantially reducing the gap between the advanced nations and emerging economies such as Nigeria.

When one considers some of the broad issues of sustainability, ICT undoubtedly will contribute positively. Examples may include the impact of technology on the lives of the physically disabled, community development, health, social security, education, and grassroots businesses, among the huge list of possibilities. The physically challenged can use technology to work from home through the invention of teleworking for persons with disabilities. Community development activities can be enhanced and supported through ICT, such as the Society for Research and Initiatives for Sustainable Technologies and Institutions initiative in which the purpose is to encourage the use of ICT to advance innovation and eco-friendly solutions to ongoing problems. Ideas can be adopted from what is done in places such as RajNidhi in Rajasthan, India where ICT is used to provide its citizens with information, such as health, family planning, employment, transportation, distance education, agriculture, water, electricity, birth and death registration, and tax rates along with many other services. Health facilities sharing health records can respond timely to individual health concerns and make more accurate decisions about health-related problems. ICT can inform members of a community about social services available and the benefits to which each individual is entitled. Technology is revolutionizing the way persons learn. World Corps, for example, use ICT to impart technical and business related skill-sets to disadvantaged persons by promoting employment through sustainable and environmentally sound enterprises, such as Internet centers whereas Community Learning Center, also in India, use technology to enhance elementary education and computer literacy among poor children. (Sameer, 2011) is of the opinion that grassroots businesses can use the Internet to sell their produce through an auction system. They can apply the technology in ways that provide information for crop production, cultivation practices, marketing initiatives, processing standards, and pest and disease control. In addition, community based initiatives include engaging the technology to advance and expand micro-financing and micro-enterprise.

2.2   THEORETICAL REVIEW ON ICT

According to Wikipedia (2010), theories of technology attempt to explain the factors that shape technological innovation as well as the impact of technology on society and culture. Most contemporary theories of technology reject two previous views: the linear model of technological innovation and technological determinism. To challenge the linear model, today's theories of technology point to the historical evidence that technological innovation often gives rise to new scientific fields, and emphasizes the important role that social networks and cultural values play in shaping technological artifacts. To challenge technological determinism, today's theories of technology emphasize the scope of technical choice, which is greater than most lay people realize; as science and technology scholars like to say, "it could have been different." For this reason, theorists who take these positions typically argue for greater public involvement in technological decision-making

2.2.1 Social theories

Social theories focus on how humans and technology affect each other. They argue that technology does not determine human action, but that human action shapes technology. Some of thesetheories focus on how decisions are made with humans and technology: humans and technology are equal inthe decision, humans drive technology and vice versa. The interactions used in majority of the theories look at individual human interactions with technology, but there is a sub-group for a group of people 'interacting with technology. The theories described are purposefully vague and ambiguous, since the circumstances for the theories change as human culture and technology innovations change. Key authors include Mackensie and Wajcman (1985).

2.2.2 Actor-network theory

Actor Network Theory posits a heterogeneous network of humans and non- humans as equal interrelated actors. It strives for impartiality in the description of human and nonhuman actors and the reintegration of the natural and social worlds. For example, Latour (2011) argues that instead of worrying whether we are anthropomorphizing technology, we should embrace it as inherently anthropomorphic: technology is made by humans, substitutes for the actions of humans, and shapes human action, what is important is the chain and gradients of actors' actions and competences, and the degree to which we choose to have figurative representations. Key concepts include the inscription of beliefs, practices, and relations into technology, which is then said to embody them.

2.2.3 Structuration Theory

Poole (2011) defines structures as rules and resources organized as properties of social systems. The theory employs a recursive notion of actions constrained and enabled by structures which are produced and reproduced by that action. Consequently, this theory technology is not rendered as an artifact, but examines how people, as they interact with a technology their ongoing practices, enact structures which shape their emergent and situated use of that technology. Key authors include DeSanctis and Poole (2009).

2.2.4 Systems Theory

This theory considers the historical development of technology and media with an emphasis on inertia and heterogeneity, stressing the connections between the artifact being built and the social, economic, political and cultural factors surrounding it. Key concepts include reverse salient when elements of a system lag in development with respect to others, differentiation, operational closure, and autopoietic autonomy. Key authors include Hughes and Luhmann (2008).

2.2.5 Activity Theory

These works consider an entire work/activity system (including teams, organizations, etc.) beyond just one actor or user. It accounts for environment, history of the person, culture, role of the artifact, motivations, and complexity of real life, activity. One of the strengths of AT is that it bridges the gap between the individual subject and the social reality it studies both through the mediating activity. The unit of analysis in AT is the concept of object-oriented, collective and culturally mediated human activity, or activity system.

2.2.5   Group Theories

There are also a number of technology related theories that address how (media) technology affects group processes. Broadly, these theories are concerned with the social effects of communication media. Some (e.g., media richness) are concerned with questions of media choice (i.e., when to use what medium effectively). Other theories (social

presence, SIDE, media naturalness) are concerned with the consequences of those media choices (i.e., what are the social effects of using particular communication media).

2.2.6 Social presence theory

Social presence theory is a seminal theory of the social effects of communication technology. Its main concern is with telephony and, telephone conferencing. Satope (2012) argues that the social impact of a communication medium depend on the social presence it allows communicators to have. Social presence is defined as a property of the medium itself: the degree of acoustic, visual, and physical contact that it allows. The theory assumes that more contact will increase the key components of "presence": greater intimacy, immediacy, warmth and inter-personal rapport. As a consequence of social presence, social influence is expected to increase. In the case of communication technology, the assumption is that more text-based forms of interaction (e-mail, instant messaging) are less social, and therefore less conducive to social influence.

2.2.7 MediaRichness Theory

Daft and Lengel(2010) are of the view that media richness theoryshares some characteristics with social presence theory. The theory posits that the amount of information communicated differs with respect to a medium's richness. The theory assumes that resolving ambiguity and reducing uncertainty are the main goals of communication. Because communication media differ in the rate of understanding they can achieve in a specific time (with "rich" media carrying core information), they are not all capable of resolving certainty and ambiguity well. The more restricted the medium's capacity, the less uncertainty and equivocality it is able to manage. It follows that the richness of the media should be matched to the task so as to prevent over simplification or complication.

2.3 EMPIRICAL REVIEW ON ICT

Sunil, Forell, Morgeson and Krishnan (2008) in their study of the effect of information technology investment on customer satisfaction hypothesized that IT investment is positively related to perceived quality and perceived value, the study findings revealed that IT investment have a positive effect on perceived quality and perceived value firms in the service sectors than in the manufacturing sector. Also Sunil, Ramasubba and Sambamurthy (2011) studied information technology infrastructure capability and firm performance. The study revealed that ITI is positively related to customer and market usage, process management and performance management of firm's performance respectively. Marchand, Kettinger and Rollins (2009) studied the link between information technology and firm performance and their study revealed that three set of factors keeps a firms performance, the quality of IT management practices. IT management processes should sense, gather, organize and disseminate information, in other words IT management is positively related to a firms performance and continual existence.

Sambamurthy, Ramasubba and Sunil (2010) in their study revealed that information technology infrastructure capabilities in firm impacts customer focus and market focus. This in other words means that IT infrastructure capabilities enable firms to position their IT asset so as to capture information about customers as well as disseminate information to customer in other to create satisfaction. Also Sambamurthy (2010) in another study argue that IT capabilities have a positive impact on the quality of organizational processes and the development of digital process and the development of digital process capabilities.

Gilanniaand Sunil (2011) in their work 'the impact of information technology application on supply chain performance' found that information technology impacts supply chain strategy and that information technology has more relationship with responsiveness supply chain, meaning IT impacts supply chain performance in an organization. Melville (2009) in his study suggested IT and the complementary resources of the firm affected the effectiveness of business processes which consequently improved organizational performance.

Karimi and Jahagir (2010) in their study revealed that good IT planning and integration are more effective at improving customer service. Ting (2010) in his study 'impact of information technology on firm's performance' argued that IT impact firm's financial efficiency and capability performance, respectively. Ray (2010) also found that there were no direct effects of three different IT resources (technical skills, manager technology knowledge, and IT spending) on the performance of customer vice process.

2.3.1 Compatibility
According to Duncan (2008),Compatibility is the ability to share any type of information across the technology component throughout the organization.Mohammad and Kamaruzaman (2009) opined that Information Technology compatibility help span organization boundaries, employee empowerment, make information and knowledge available in the organization. Gibson (1993) noted that compatibility addresses the need for uniformity in technology across the organization.Kamal (2013) in his study revealed a positive correlation between compatibility and reliability of service. Akbulut (2012) in his study observed that compatibility is positively correlated with access to service, in that compatibility creates ease of use.

2.3.2 Connectivity
Duncan (2008) observed that connectivity is the ability of any technology components to communicate with any of the other components inside and outside of the organizational environment. According to Chaung (2009) Information Technology connectivity enable seamless and transparent organisations that are independent of time and space. Keen (1991) described connectivity as the physical presence of information technology that binds the organization together. He further suggested the term "reach", to address the issue of connectivity. He defined reach as the location that can be connected via the IT infrastructure.

Keen (2010) also noted that 'reach' is required to achieve an organization's desired level of data transparency. In addition Byrd and Turner (2010) noted that connectivity refers to the ability of any technology to attach to any of the other technology component. It also means that every person, every functional area, and every application in the organizations are linked to one another. Mohammad and Kamaruzaman (2009) hypothesized and found that connectivity is correlated with reliability. While Chaung (2010) hypothesized and found that connectivity is significantly correlated with access.

2.4   SUSTAINABLE DEVELOPMENT
According to Stern (1997), sustainable development first appeared in the World Conservation Strategy put forward by the International Union for the Conservation of Nature (IUCN) in 1980 where economic growth was seen as an enemy of environment. But prominent meaning of Sustainable development is the Brundtland Report (WCED, 1987) which proposed that sustainable development is "development that meets the needs of the

present generation while letting future generations meets their own needs. In recent years, economists have made progress in articulating their conception of sustainability. Crucial to this is that scholars have been able to synthesize SD into three pillars; economic development, social equity and environmental protection pillars (United Nations, 2007).

There are two main criteria of sustainable development; Weak Sustainability (WS) and Strong Sustainability (SS). "Weak sustainability" refers to non-declining total capital (productive base) in the form of physical, human and natural capital. The WS rents from natural resources could be invested (substituted) in manmade capital and/or human capital to ensure sustainable development. Strong sustainability on the other hand, means a threshold level of some forms of capital (physical, human, social, and natural) to be preserved in physical terms. According to Amsalu (2011), it is the WS criterion that is being employed most widely because of scarce resource with alternative uses.Weak sustainability is all about forms of capital that are substitutable for each other. More so, requires in addition to WS, the stocks of capital (K) should not be declining. Adejumo and Adejumo (2014), stated that "Addition to" is preferred because a situation in which natural capital is preserved while other forms of capital are allowed to decline significantly can hardly be called "sustainable development"Tern (1997) stated that there is a consensus among a large number of economists that weak sustainability supports the capital theory approach (CTA) and is a useful means of measuring sustainability especially in inform of policy making. (Common and Norton 1994) noted that there are also a growing number of critics who question whether this is a useful way to address sustainability.

Though the human needs included in the definition is of recent thinking, Soubbotina (2004) and Harry (2010) views that human beings are the epicenter for sustainable development. The criterion of this study is trying to capture sustainable development as much as possible from the weak sustainable development capital approach (productive base) that is substantial to be bequest to next generation with human capital bias, a position Martin (2006), also agreed. Eric (2010) equated weak sustainable development with sustained growth. The productive base consists of all forms of capital assets in a given economy such as; physical (reproducible- manufactured) capital, human capital (skills and knowledge embodied in humans) natural capital (energy, minerals, forests, water, and land). An example is how provision of Air condition (AC) suffices heat caused by high temperature in the daytime.

Here, the pillars or elements of the sustainable developmentare roughly subsumed as productive inputs. These are the inputs of production process that drives any economy to be sustainable development or not and are broadly categorized as; land (all natural resources or capital), labour (energy, person-hours, aspects of human capital), and capital (real and working capital, financial capital, manufactured capital etc.). According to Seidler (2000), most neoclassical economists are of this view especially the famous Cobb Douglas production function in 1928 where he assumed input substitutability factors of production function.

2.5   EFFECT OFICT ON NIGERIA'S SUSTAINABLE DEVELOPMENT

Although grasping the phenomenological inter relationships and interconnectedness concept between sustainability and development may be somewhat arduous, such realities cannot be ignored. (Baudouin, 2009) is of the view that contemporary cities, towns, etc. need to share data for effective urban planning. Without such cooperation, the three

fundamental characteristics of sustainability: environmental, economic, and societal responsibilities will not materialize. Enterprises and governments alike must therefore enact initiatives that build cities, towns, and other communities that are "economically efficient, socially equitable and ecologically viable". In the absence of these key factors, sustainability is impossible. Cities constantly evolve hence the digital impact on such dynamism must therefore be factored in terms of its impact on transportation and other urban facilities and how people deploy the technology to stay connected and to make choices. Sustainability must be seen as a strategic endeavor in the face of rapid urbanization across countries and cultures. In this regard, sustainable development must go beyond using cell phones merely to chat. Enriching data services would be a step in the right direction to conduct banking, financing, and other such financially viable services.

Baudouin (2009) also proffered that with proper sustainability adaptation, homes could transform relationships, for example, the electric company implementing smart meters. He further opined that portable devices can increase worker productivity substantially. He argued that such improvements can occur in public services, tourism, culture, social interactions, community development, and in governance at the local and national levels. The BEEP methodology (Best eEurope Practices) funded by the European Commission, for example, documents workable solutions across the globe readily available for adaptation. The method gives planners and implementers the ability to adopt good practices, exercise proper evaluation, analysis, and learning, thereby creating an effective knowledge management system for sustainable deployment. According to Odamtten and Millard (2009), Eastern Europe and the Mediterranean benefitted significantly in using BEEP to transform their economies as a precursor to enter the European Union whereas the Pan-African region is slowly getting on board. Inherent in the BEEP method, is the recognition that there is no absolute solution. Each region and countries differ on many variables, such as culture, governance, economics, and skill-sets.

Initiatives from the above can lead to gender equality through empowerment, development through capability building, and through alternatives that propel competitiveness. Emerging strategies may include economic growth, sustainable livelihood, and increased freedom for capacity enhancement and expansion. In addition to the foregoing, free and open source software (FOSS) presents countries with unique opportunities for sustainable development. Papua New Guinea, a country that relies heavily on Australia for just about everything economic, embraced FOSS and used it as a driving force to implement cutting-edge information technology solutions comparable in price to developed states. Papua New Guinea chose FOSS, not because the country could not implement telecommunications technology in the way others have, but because to do so would make the service cost disadvantageous in comparison to advanced economies. FOSS was the clear choice to maintain comparable cost structures. If one should examine the price of Windows XP as an illustration, acquiring a copy in the United States is likely cheaper than to do so in Nigeria. Proprietary software are priced per market segment and the poorer the segment, the higher the price. FOSS removes such restrictions. Open source software maintains similar price structures irrespective of markets. In addition, such prices tend to be lower than their comparative proprietary choices. Wheeler, as cited by Reijswoud (2009) noted that: Briefly, free and open source software programs are programs whose licenses give users the freedom to run the program for any purpose, to

study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers).

According to Reijswood (2009), although one should indicate that open source software is not always free, FOSS with its bazaar and study development method steeped in sound academic principles, provide considerable advantages. These may include lower total cost of ownership, free base level technical support, fee for service for popular open source software (Red Hat, IBM, Novell, Sun, Oracle,) and shared ideas and knowledge among programmers.

CONCLUSION

There are challenges to using ICT as the driving force for sustainable development. However, ICT provide its greatest hope. This paradox, although cannot be ignored must be assessed in the context of modernity and the role that ICT enjoy in the contemporary context. ICT advances "economic, social, cultural, and political" initiatives in ways that affect all stakeholders positively when done correctly. ICT situate countries and enterprises to achieve sustainability in efficient ways. ICT furnish the platform to integrate "assessment of the ecological, social, and economic features and implications of a given project, technology or agro-ecosystem through the use of appropriate indicators. ICT is therefore, an appropriate tool for advancing sustainable initiatives. Without ICT, many of the contemporary benefits occurring globally would not have likely materialized. To this extent, emerging economies can use ICT to their advantages. ICT can create cost competitiveness by neutralizing extenuating circumstances. ICT accrue benefits to regions by bringing technology to remote areas where traditional technology would have been too costly. Sustainable development through ICT initiatives is therefore a reality need only to be embraced by those who realistically demand societies that are more equitable.

RECOMMENDATIONS

- ❖ Competent and experienced ICT experts should be recruited by the state and federal government as instructors to sustain and make the programme sustainable.
- ❖ Government policies should be geared towards indigenous firms/entrepreneurs and encourage her citizens to invest in information and communication Technology
- ❖ Form the primary to the tertiary education level, ICT and other related courses should be encouraged that will prepare the teeming graduates to be job creators and not job seekers.
- ❖ To make the ICT programme more sustainable, rural areas, children, youths and adults should be identified and trained to bridge the gap.

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