Available online www.ejaet.com

European Journal of Advances in Engineering and Technology, 2024, 11(4):1-5

Research Article ISSN: 2394 - 658X

Utilizing Information and Communication Technology to Mitigate Climate Change in Nigeria

[1]Olotu, Y., [2]Nasamu, J.A., [3]Akhuewu, D.E. and [3]Musah, A. A.

[1]Department of Agricultural & Bio-Environmental Engineering, Auchi Polytechnic, Auchi, Nigeria
[2]Department of Mass Communication, Auchi Polytechnic, Auchi, Nigeria
[3]Department of Computer Science, Auchi Polytechnic, Auchi, Nigeria

---

ABSTRACT

Information and communication technologies (ICTs) have several applications in manufacturing, agriculture, and socioeconomic development. They can also be used as a tool to mitigate climate change by lowering greenhouse gas (GHG) emissions, specifically CO_2 emissions. The rate of increase in carbon dioxide emissions is in line with the worst-case scenario (RCP 8.6) for global warming. ICT accounts for 2.3% of CO_2 emissions, but using Smart-ICT can offset this effect by 97.7% in the manufacturing, transportation, and building sectors. ICTs can help with both these and Nigeria's climate change-related issues. ICTs can be used to help Nigeria adapt to climate change and lessen the impact of other sectors on greenhouse gas (GHG) emissions.

Key words: ICT, CO_2, Climate change, GHG, Emission, Mitigating

---

INTRODUCTION

Both developed and developing countries face many environmental challenges, including climate change, improving energy efficiency and waste management, addressing air pollution, water quality and scarcity, and loss of natural habitats and biodiversity [1]. “We all know that information and communications technologies (ICTs) have revolutionized our world. ICTs are also very vital to confronting the problems we face as a planet: the threat of climate change. Indeed ICTs are part of the solution. Already these technologies are being used to cut emissions and help countries adapt to the effects of climate change [1]. Governments and industries that embrace a strategy of green growth will be environmental champions and economic leaders in the twenty-first century.” Information and communication technologies (ICTs) are a combination of devices and services that capture, transmit and display data and information electronically [2]. These include personal computers (PCs) and peripherals, broadband telecom networks and devices, and data centres.

Climate change is defined by the IPCC [2], changing in climate; naturally or by human beings, climate changes impose negative impacts on environment and human life. According to the “United Nations Framework Convention on Climate Change [9]” major climate changes are, Global Warming (increases in average global temperature) resulting in heat waves, bush fire, extreme temperature, droughts. Melting glaciers is resulting in increasing water level in rivers and floods intensity and frequency. Sea water is continuously absorbing carbon dioxide (CO2) and heat from the atmosphere which is one of the major causes of rising ocean temperature and ocean acidity. Air pollution as a climate change is dangerous and harmful for inhabitants [9].

Carbon dioxide emissions are growing at a rate that is consistent with the worst-case scenario for global warming [3]. The Fourth Assessment Report of the Intergovernmental Panel on Climate Change along with the Stern Review predicts that unless this trend is reversed, it will have dire consequences, including catastrophic changes to key earth systems. Although historically associated with the world's developed countries, greenhouse gas (GHG) emissions are fast becoming a developing country issue [4]. Developing countries already account for 50% of global GHG emissions and by 2030 this figure is expected to rise to 65%. At present, the least

developed countries are minor contributors – responsible for just 0.5% of cumulative emissions between 1995 and 2008. The major sources are the "emerging economies", particularly Brazil, China, India and South Africa the largest emitters on their continents [4].

This paper explores how ICT and related Nigeria communities can help tackle environmental challenges. The linkage on the role of ICTs in: (i) climate change mitigation (e.g. investing in smart transport and energy efficient infrastructure); (ii) mitigating other environmental pressures (e.g. biodiversity loss, water and soil pollution); (iii) climate change adaptation (e.g. adapting to rising sea levels, droughts, desertification); and (iv) international co-operation (e.g. technology transfer and the development of sustainable ICT value chains), will be well established [5].

ICT AND THE ENVIRONMENT

The relationship between ICTs and the environment is complex and multifaceted, as ICTs can play both positive and negative roles [7]. Positive impacts can come from dematerialization and online delivery, transport and travel substitution, a host of monitoring and management applications, greater energy efficiency in production and use, and product stewardship and recycling. Negative impacts can come from energy consumption and the materials used in the production and distribution of ICT equipment, energy consumption in use directly and for cooling, short product life cycles and e-waste, and exploitative applications (e.g. remote sensing for unsustainable over-fishing [3]. Nevertheless, the indirect enabling impacts of ICTs are greater, and a number of studies have identified potentially significant net positive impacts from ICTs. For example, The Climate Group [3] identified key areas of enabling impacts potentially leading to global emissions reductions by 2020 that were five times the ICT sectors direct footprint (Figure 1).

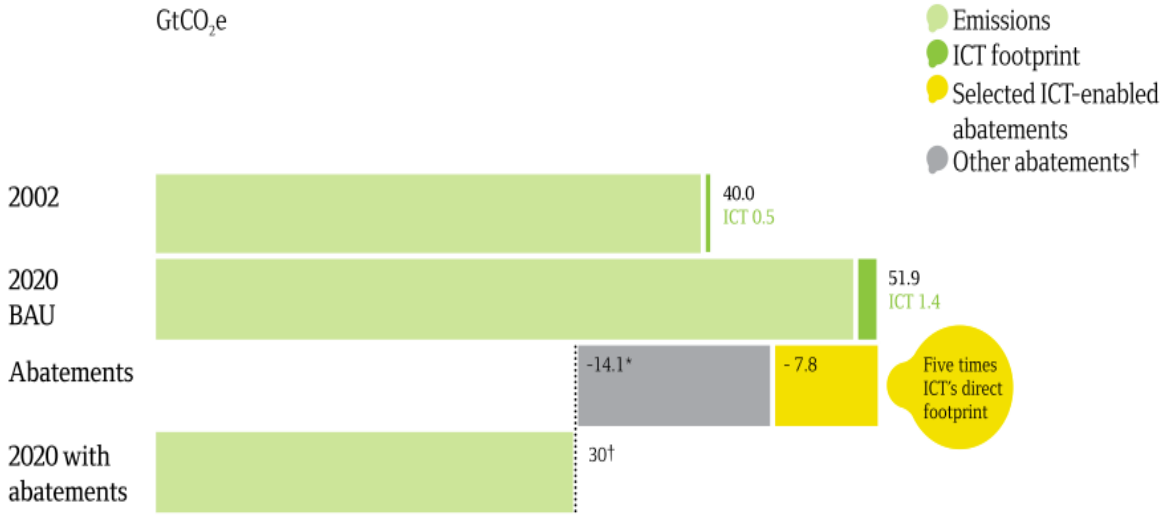

Figure 1: ICT Impact: The global footprint and the enabling effect [9]

USING ICTS AS A REWARD MECHANISM FOR CONSUMERS TO REDUCE GHG EMISSIONS

Reducing or eliminating the ICT industry's direct GHG emissions through zero carbon data centers and new network and distributed computing architectures is most likely the “low hanging fruit” of an ICT strategy aimed at mitigating climate change [2]. The much bigger challenge is how to use ICT technology to induce businesses and consumers to reduce the carbon footprint that results from their daily activities, such as building heating or cooling and transportation. According to a recent report of the Confederation of British Industry (CBI), consumers control or influence 60% of all GHG emissions, of which 35% are under direct consumer control through their own consumption and use, and 25% through consumer-influenced sectors such as food and drink, entertainment, etc. As such, finding ways to encourage consumer to reduce their carbon footprint will have a dramatic impact on overall global GHG emissions [4].

Past attempts at such a strategy have focused on efforts like tele-commuting or tele-presence. Although these continue to be worthwhile initiatives, they lack widespread consumer appeal due to externalities such as basic inconvenience, insufficient broadband bandwidth, and lack of incentive to adopt what is at present an inferior technique of interacting with colleagues and friends. Making a difference to GHG emissions by changing consumer behaviour is likely to require a different approach [6]. One of the outstanding successes of the Internet

economy over the past decade has been the growth in consumer-oriented electronic products and services such as music, film, advertising, photography online searches and so on. Therefore, it is postulated that one area of possible innovation and economic opportunity is to see if new applications and services can be developed to encourage consumers to reduce their carbon footprints by trading activities, products and services that result in GHG emissions for Internet and ICT-based activities, products and services that do not [10].

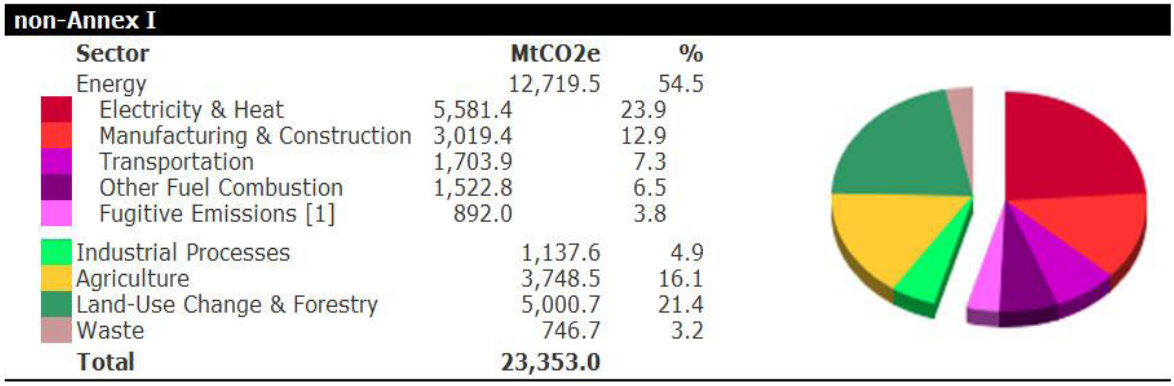

Figure 2: GHG Emissions by Sector in Developing/Emerging Countries [8]

The ways in which ICTs can make contribution to climate mitigation are as follows in Fig. 3:

Green ICT: the reduction of carbon emissions from ICT production and consumption.

Smart ICT: the application of ICT in other sectors to save both money and emissions.

Community ICT: the use of ICTs within developing country communities in which, as yet, green and smart ICT applications play little role.

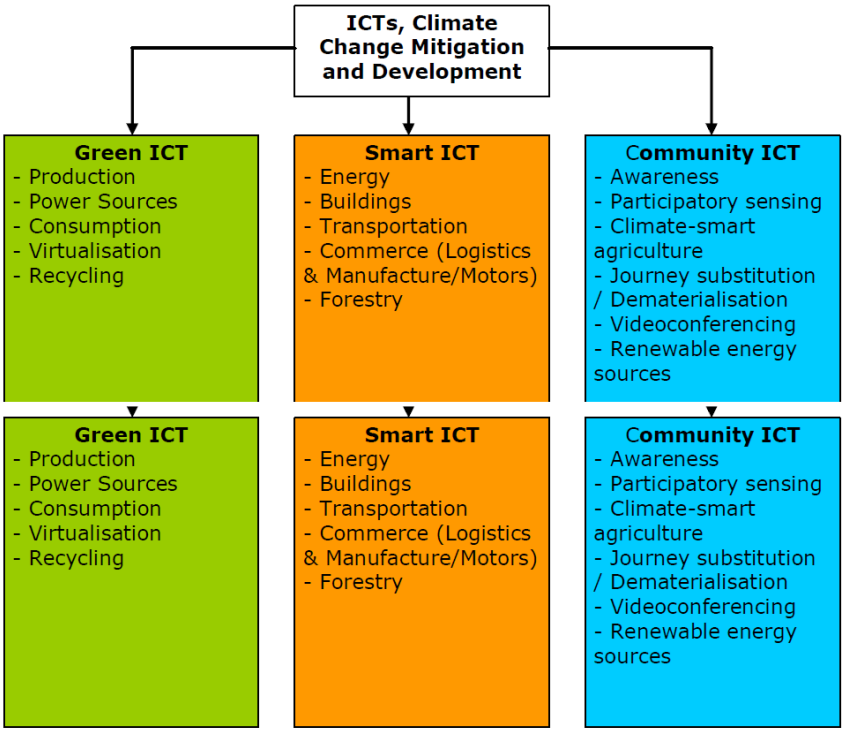

Figure 3: Mapping ICTs' Contribution to Climate Change Mitigation [6]

According to Gartner, the ICT industry "accounts for 2% of global CO2 emissions"[8]. This is expected to increase by 6% each year until 2020[8]. 40% of these emissions come from the operation of PCs and monitors, and 23% from data centres [7]. Emissions from data centres are rising particularly rapidly and the proliferation of mobile devices in developing countries is also making an increasing contribution.

3.1 Using ICTs to monitor the global environment/ecosystem

It has been predicted that rise in average temperature of 1.1-6.4°C6 during the 21st century will be experienced [6]. The results will be uneven in their distribution, with low-lying coastal areas at risk because of rising sea levels and sub- Saharan Africa at risk due to desertification [6].

ICT systems that are involved in environment and climate monitoring, data dissemination and early warning include:

• weather satellites that track the progress of hurricanes and typhoons;

• weather radars that track the progress of tornadoes, thunderstorms, and the effluent from volcanoes and major forest fires;

• radio-based meteorological aid systems that collect and process weather data, without which the current and planned accuracy of weather predictions would be seriously compromised;

• Earth observation-satellite systems that obtain environmental information such as atmosphere composition (e.g. CO2, vapour, ozone concentration), ocean parameters (temperature, surface level change), soil moisture, and vegetation including forest control, agricultural data and many others.

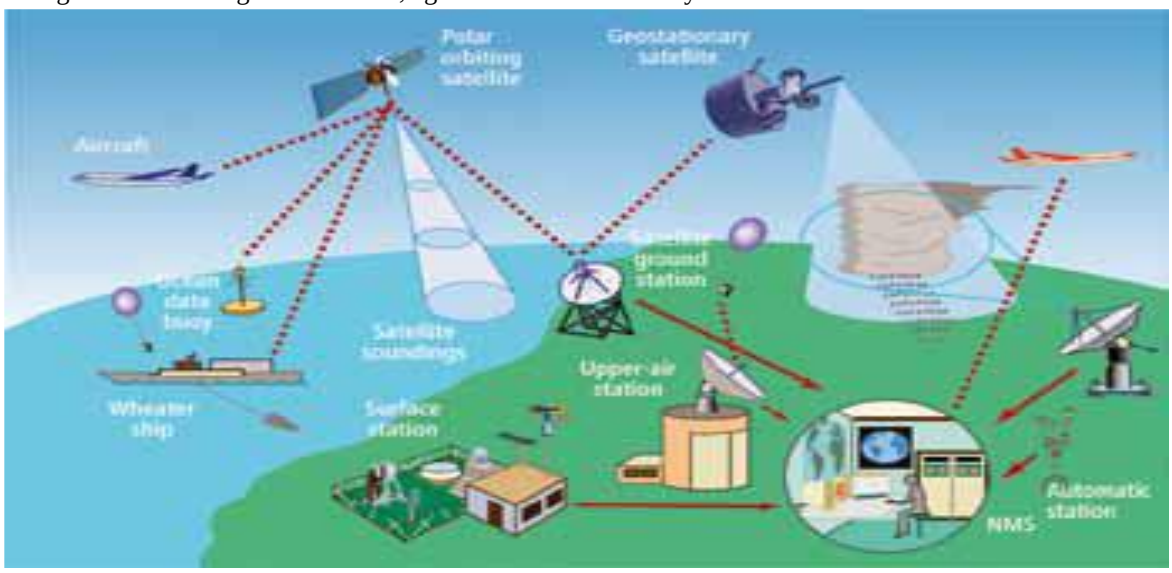

Figure 4: WMO Global Observing System [6]

All these systems form the Global Observing System – GOS (Fig. 4). GOS is the primary source of technical information on the world's atmosphere, and is a composite system of complex methods, techniques and facilities for measuring meteorological and environmental parameters. It is employed by the majority of countries.

3.2 Using ICTs to increase energy supply efficiency and maximize the use of renewable sources

ICTs can be used to maximize the efficiency of power systems. Their computing and communications capabilities are essential if power from renewable resources such as geothermal, solar, wind, and wave and tidal, and are to be harnessed efficiently and fed into the electricity grid in a smart way. ICTs are required to control the load on the grid by maximizing the utilisation of available solar, wind and tidal power for example. ICTs are able to model the real-time status of renewable energy systems taking into account local weather stations, so that transmission losses are minimized by selecting the shortest route from source to load [3]. Fig. 3 shows an ICT system that is able to show the availability of hydro-energy in a user-selected drainage basin collecting mountain runoff in Guatemala. Using this information, turbines located downstream may be switched on to the grid to match demand [3].

Also of significance is the impact of ICT services on emissions from other sectors. ICT devices are used to improve the efficiency of all other sectors and are pervasive throughout society. ICT services offer global coverage and efficiency gains which greatly enhance economic growth. The challenge is to channel this growth so that it is sustainable and the problems of climate change are eliminated. Our studies have shown that ICT services can have a mitigating effect in other sectors.

CONCLUSION

ICTs are becoming ubiquitous throughout society. Telecommunication networks and the Internet ensure that information is available at the touch of a keypad, and with (mobile) phones you can speak instantly to anyone in the world. ICTs can improve the efficiency of logistics operations in a number of ways by helping to monitor, optimise and manage operations. This in turn helps reduce the storage needed for inventory, fuel consumption, kilometres driven and frequency of vehicles travelling empty or partially loaded. Smart logistics solutions include software enabling improved design of transport networks, running of centralised distribution networks and of management systems facilitating flexible home delivery services. The developing world such as Nigeria is particularly vulnerable to changing climatic conditions and is not well served with Internet and voice communications. Bridging the digital divide is essential to assist the developing world to plan for adaptation and to enable a rapid and fully informed response to extreme conditions.

REFERENCES

[1]. EC (2009) ICT for a Low Carbon Economy, European Commission, Brussels http://ec.europa.eu/information_society/events/shanghai2010/pdf/smartbuildingsld_for_press_pack.pdf

[2]. Gross, I. (2012) Mitigating ICT Related Carbon Emissions: Using Renewable Energy to Power Base Stations in Africa's Mobile Telecommunications Sector, Centre for Development Informatics, University of Manchester, UK http://www.niccd.org/NICCD_Mitigation_Case_Study_MobileBasestations.pdf

[3]. Jones, R. & Siemering, B. (2012) Combining Local Radio and Mobile Phones to Promote Climate Stewardship, Centre for Development Informatics, University of Manchester, UK http://www.niccd.org/NICCD_Mitigation_Case_Study_Cookstoves.pdf

[4]. Labelle, R. & Rodschat, R. (2009) e-Environment Toolkit and Readiness Index (EERI), International Telecommunication Union, Geneva http://www.itu.int/ITUD/

[5]. Mahalik, D.K. (2012) Reducing Carbon Emissions through Videoconferencing: An Indian Case Study, Centre for Development Informatics, University of Manchester, UK http://www.niccd.org/NICCD_Mitigation_Case_Study_VideoConferencing.pdf

[6]. Meche, M. (2009) ICT: Enabling the Sustainable City and Community, Cisco http://siteresources.worldbank.org/EXTEDEVELOPMENT/Resources/5594591264017672742/CISCO_Worldbank.pptx

[7]. Pamlin, D. & Szomolanyi, K. (2005) Saving the Climate @ the Speed of Light, WWF and ETNO http://assets.panda.org/downloads/road_map_speed_of_light_wwf_etno.pdf

[8]. Roeth, H. & Wokeck, L. (2011) ICTs and Climate Change Mitigation in Emerging Economies, Centre for Development Informatics, University of Manchester, UK http://www.niccd.org/RoethWokeckClimateChangeMitigationICTs.pdf

[9]. The Climate Group/GeSI (2008) SMART 2020: Enabling the Low Carbon Economy in the Information Age, The Climate Group, London http://www.smart2020.org/publications/

[10]. WWF (2008) The Potential Global CO2 Reductions from ICT Use. WWF, Stockholm http://www.wwf.se/source.php/1183710/identifying_the_1st_billion_tonnes_ict.pdf

[11]. Youngman, R. (n.d.) *ICT Solutions for Energy Efficiency*,