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Original Article

ICT for Sustainable Development without Digital Divide in Africa

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Abstract *- One of the most noteworthy challenges in society in the 21st century is sustainable development. The usefulness of ICT has led to an overwhelming demand for electronics such as computers and mobile phones. ICT is vital for poverty reduction and in the growth of sectors such as agriculture, business, health, education etc. Applying ICT to drive any development has its advantages and disadvantages. Therefore, its measurement should be focused on whether the benefits outweigh the pitfalls. The purpose of carrying out this research is because most development initiatives in Africa are being undertaken with the use of ICT. Therefore, this paper surveys the literature on ICT for sustainable development without the digital divide and how ICT can lead to un-sustainability in Africa. Findings indicate that driving sustainable development through ICT initiatives bring much greater benefits than negative consequence.*

Keywords *- Constrains to sustainable ICT, ICT application, ICT, sustainable ICT*

I. INTRODUCTION

Information and Communication Technologies are becoming commonplace thing [1] and take part in important roles in areas of development like education [2], health [3] etc. According to Beckinsale & Ram [4], ICT is defined as any technology used to support gathering, processing, distribution and use of information. Nicol [5] classifies ICT into information technologies, telecommunications technologies and networking technologies. According to Manueli, Latu & Koh [6], ICT covers all forms of technologies such as computers, the Internet, websites, as well as fixed-line telephones, mobile phones and other wireless communications devices, networks, broadband and various specialized devices. Sustainability is the ability to continue a defined behaviour indefinitely [7]. Thus sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

ICTs have a significant impact on society, and their appropriate utilization has proved to have important results for socioeconomic development at large and environmental sustainability in particular [8]. Expectations are high that progressive innovation in (ICTs) can be harnessed to sustainable development and, specifically, to environmental sustainability goals [9]. Also, ICT is an essential tool in advancing agriculture which is the largest economic sector in Africa and Tanzania in specific and which is both a victim and cause of environmental degradation ([10]; [11]).

II. THE PROBLEM

Gilhooly [12] argues that ICT provides opportunities that are new for those who are literate, have a good education, and have adequate resources. Therefore, the challenge is how African countries engage the use of ICT in strategic ways that advance social, economic and cultural activities for all its stakeholders in sustainable development advancement. ICT application has its advantages and disadvantages, according to Mansell [9], who states that ICTs support environmental monitoring; however, they also promote environmental decline. During this Corona (COVID 19) epidemic, many a country has tried to employ ICT to ensure learning continues with learners at home following educational institutions spending face to face learning. This has brought out the challenge of the digital divide clearly with reference to access, affordability and connectivity between different learners and regions. The prime motivation for carrying out research on ICT for sustainable development without the digital divide in Africa is because Africa is a developing continent, and most countries are trying to integrate ICT into their initiatives.

III. ICT for SUSTAINABILITY

The application of ICT in development initiatives has proved to be of much importance in several ways, as discussed below:

A. Information Management and Storage

Chapman & Slaymaker [13] state that ICTs present outstanding information storage capacity, increases in processing power and speed, together with remarkable cost reductions. Also, ICTs facilitate the improvement of existing information management processes by improving ease of access, transparency, accountability, efficiency, delivery speed and providing new information-sharing opportunities through affordability, availability and ease of use. The extended multi-media capabilities of

technologies offer the potential for information storage and presentation in formats that are appropriate to local contexts and therefore encourage greater integration of different information systems [13].

B. Waste Minimization

According to Haghseta [14], waste minimization is defined as achieving material and energy reduction per unit of product or service produced. Information Technology promotes material reuse through the exchanges and auction sites on the Internet. On the side of the business, a significant industrial secondary market is established on the Internet. Buyers of industrial products are able to buy materials from all over the world cost-effectively through online exchanges.

C. *Economic Stimulation*

The decreasing costs and growing accessibility and diffusion of Information Technology lead to potentially enormous prospects for stimulation of developing economies [14], [15]. Citing an example, Information Technology enables developing countries to leapfrog old technologies such as copper wires and invest in wireless infrastructure, which is usually cheaper to install and easier to maintain. Therefore, it helps to drive the growth of new and profitable sectors.

According to Mansell [9], the digital ICT paradigm is accompanied by new types of organization, skills, product mixes and patterns of investment. ICT innovations significantly reduce the cost of storing, processing, communicating and disseminating information and they become linked to new patterns of behaviour and practices. The possibility of transferring digital content to remote locations easily in the form of text, images, video and radio combined with the vast storage capacity of PCs, CDs and DVDs reduces many of the costs associated with barriers to broad-based access to information [13].

ICT has made great advances in the ability to discover, retrieve, and integrate information from sources that are geographically dispersed, varying in context, and heterogeneous in format [14]. Intelligent integration capabilities have had important applications in fields as diverse as environmental monitoring and financial services. For example, one can transfer money from his bank account to his mobile phone.

D. More information access

ICTs have led to more information available that is easy accessibility. Globalization and continued liberalization of agriculture have significantly changed the market and institutional environment in rural areas [13]. In terms of market opportunities, emerging agricultural technologies are increasingly information intensive. ICTs present massive potential in support of improved education and training and need to be harnessed to build long term decision-making capacity in rural areas. ICT leads to improved access to education and training through distance learning programmes and educational tools in a wide range of different formats [13].

Women play a major role in family, community and social development. According to Meera & Andrew [17], radio and mobile phones play a major role in improving the status of women in rural Africa, where some women are denied access to health and literacy. Citing an example, Women Farmers Advanced Network (WOFAN), which operates in rural areas in northern Nigeria, noticed how women use radio programs to teach themselves concerning how they are denied basic rights for education and health. Also, the author states that women's Voices, a video initiative in Kenya, helped women to learn scripting, shooting and editing. This covered incidents of conflict in their settlements challenge women to face, health-related risks like HIV/AIDS, orphans left homeless by infected parents, living conditions of the elderly and legal issues.

E. Creating linkages for partnerships in information sharing

ICTs help in empowering the poor to take control of their knowledge environment [13]. This leads to improved sharing of information locally, resulting in greater choices for livelihood strategies, e.g. cataloguing and sharing experiences between farmers. Meera & Andrew [17] brings forth that access to information in agricultural sectors improves the livelihood of farmers. Once internet connectivity is achieved and sufficient training is given, farmers in the agricultural sector use e-mail to communicate with their counterparts, surf and check important information about crops, better production and processing information, and extreme climate changes. Agricultural information portals (e-agriculture), in general, provide a messaging system with easy access to agricultural information and discussion forums.

ICT bridges the information gap by providing rural people access to valuable information and transmitting indigenous and locally produced knowledge on various aspects [8]. Mtega& Malekani [18] state that in Tanzania, telecentre services are reliable and more affordable means of communication, especially in rural areas and provide services such as computer training, internet access, conference facilities and meetings, secretarial and consultancy services, telephone, and community radio.

F. ICT for environmental sustainability

ICTs potentially **e**nable enforcement of the environment by citizens, thus bringing alerts on all kinds of infringements to decision-makers and ensuring the ICT power reaches and influences the opinion of the public with regard to environmental sustainability [8]. This happens in a number of ways: first, at the institutional level, ICTs lessens paper use and brings about resource management that is better, networking and exchange of information. For the researchers, ICT presents tools that are significant in simulation, observation and environmental analysis processes, while for the educators, ICTs make teaching and learning more efficient while extending resources of education about caring for the environment to a larger community.

Concerning environmental observation, ICT tools such as remote sensing, data collection and storage tools, telemetric systems, meteorological and climate-related recording and monitoring systems as well as Geographic Information Systems are capable of data recording and monitoring [11]. According to Mushi & Maharaj [8], in developing countries like Tanzania, mobile telephones and radio calls are being used to observe and report wildfires and facilitate the mobilization of communities and other emergency service providers to confront disasters.

In relation to ICT and environmental analysis, ICT tools are used to assess the quality of land, soil and water [8]. Some ICTs are used to analyze atmospheric conditions, including Greenhouse Gas (GHG) emissions and pollutants, track water quality and availability, and so an example is the use of grid computing and environmental modelling software which is helpful in developing and understanding environmental complexity and the functioning of the ecosystems [19].

G. Lifestyle Changes

ICT significantly affects sustainable development by affecting consumption patterns and preferences [14]. First, ICT advances have helped to provide transportation alternatives that are more amenable to sustainable development by reducing the transportation load due to commuting. Also, teleconferencing allows employees to conduct meetings without having to travel. Next, the availability of online stores reduces the need to go to physical stores for shopping. Finally, transportation needs for the physical delivery of goods are being alleviated through the online delivery of goods, such as music, books, and other information that can be downloaded right to a user's computer without the need of a physical transportation intermediary.

IV. ICT FOR UNSUSTAINABILITY

There are several constraints to the application of ICTs for sustainable development, which are discussed below:

A. Decrease in Quality of Information

The Information Technology revolution, particularly the advances in the Internet, has enabled tremendous growth in the quantity of all types of information [14] and especially in the knowledge-based economy [16]. The author in [14] further states that the consistent growth in the quantity of information has not translated into an increase in the overall quality of information available via the Internet. Instead, the overall quality of information has decreased due to a dilution effect caused by a wide range of information sources and the unreliability of many of the sources. Since the information provided by Information Technology tools and services is often assumed to be usable and even reliable where the reverse may be true, this trend has potentially serious implications for utilizing ICT for sustainable development because information users could be relying on unsound information for guidance.

B. Private information and the cost of access

Information is fundamental in economic transactions, and different economic agents are prepared to pay for information that is relevant to them [13]. However, the free flow of information is a critical factor underlying the efficient functioning of markets. Addressing inequitable access to information should be a key concern in order to make markets work for the poor.

C. Job loss

ICT has enabled many jobs to be automated; thus, few individuals are required to carry out the work. Thus, several people get displaced [17]. Also, innovation creates new jobs which require new skills, which some workers who are displaced may not be able to learn. Furthermore, not all displaced people find new work unless they are able to learn new skills and apply them.

D. Waste Increase

Due to shorter innovation cycles, many Information Technology products have shorter life spans, leading to an increasing amount of waste electrical and electronic equipment [14]. Furthermore, many Information Technology products contain substances that are hazardous to the environment and human health, such as halogen-organic compounds and heavy metals, which are difficult to dispose of, recycle or reuse.

V. SUMMARY AND RECOMMENDATION

The adoption of ICTs to enable any development has its strongholds and disadvantage. This paper was set out to explore the ICT for sustainable development can be achieved without the digital divide. It has been found that ICTs constitute a range of potentials to enhance sustainability, that is, human, economic and environmental sustainability. Africa's economic scale can improve with the growth of the communication industry, electronic industry, internet users, software industry and the business market related to these industries. It is recommended that other studies should be undertaken with regard to how ICTs can be utilized to empower women in rural areas, especially Kenya, in a sustainable manner without creating a social and digital divide.

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