**ICT INTEGRATION IN EDUCATION FOR SUSTAINABLE DEVELOPMENT**

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***“Education is the most powerful path to sustainability. Economic and technological solutions, political regulations or financial incentives are not enough. We need a fundamental change in the way we think and act.”***

**ABSTRACT**

 This paper outlines how ICTs in general will promote Education for sustainable development (ESD). The ESD can be promoted by acquiring ICT skills in various ways which include: software development commercial outfit, computer training maintenance, networking and internet service as well as enhancing teaching and learning activities etc. Also this paper emphasizes the possibilities for locating independent working environment through ICT facilities such as economic sustainability, social sustainability, and political sustainability. It also looks at the possible challenges of implementing ICT such as lacks of maintenance culture, budgetary constrain, and infrastructure related problems. Finally the paper emphasized that proper utilization of ICTs is necessary for promoting Education for sustainable development (ESD) in countries.

**KEYWORDS**

**Information Communication Technology (ICT) Skills, Sustainable Development, Prospects and Challenges**

**INTRODUCTION**

Today, we are living in a knowledge-based society and knowledge-based global world where countries around the globe are dependent upon Information and Communication technologies (ICTs) to bring sustainable development. One of the important problems that are facing by the developing countries today is sustainable development. Information and Communication Technologies (ICTs) refers to a technology employed in the form of tools, equipment and application which include printed media, radio and television, as well as newer digital technologies such as computers, digital video camera, laptop and the internet have been considered as potentially powerfully enabling tools for educational change and sustainable development. When different ICTs are used wisely and judiciously it is said to assist expand access to sustainable development. By strengthening the relevance of ICT in education including both private and public sectors will lead to the success of achieving goals and objectives for self-reliance. ICTs stand for information and communication technologies which can be defined as a “device set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information” These technologies include computers, the internet, digital video camera, multimedia projector, broadcasting technologies (radio and television), and telephony.

The term “ICT” provides how to use computer-based technology and the internet to make information and communication services available to a wide range of users. The term is used in broader manner to address a range of technologies, including telephones, laptops etc. Central part to this is the internet provides the way and mechanism for transporting data in a number of formats including text, images, sound, and video. The use of ICT is playing a vital role in the field of education in so many ways. It provides immense help and assistance to students, teachers, guidance and counseling personnel, educational planners and research workers in performing their responsibilities as adequately as possible. ICT’s application enables information to be collected, analyses the required information and then distributes the desired information to the targeted audience. The term ICT also refers to: *information channels* such as the *World Wide Web,* online database, electronic documents, management and accounting systems, intranet, etc. communication channels such as e-mail, electronic discussion groups, electronic conferences, the use of cell phones, etc. hardware and software used to generate, prepare, transmit, and store data, such as computers, radio, TV, computer programmes/tools, etc. (International Institute for Sustainable Development, 2007).

**WHAT IS SUSTAINABLE DEVELOPMENT?**

Sustainability is a way of thinking about a future in which environmental, social, cultural and economic growth are balanced to enable development and an improved quality of life. Sustainable development addresses the local contexts of these three areas. The United Nations defines sustainable development as a “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”. Present communities have a responsibility to live a useful life within existing ecological limits while conserving natural resources. The ideals and values that form a basis of sustainability include equity among generations, gender equity, peace, tolerance, poverty reduction, environmental preservation and restoration, natural resource conservation, and social justice.

 **WHAT IS EDUCATION FOR SUSTAINABLE DEVELOPMENT?**

Education is considered as a primary agent of transformation towards sustainable development, increasing people’s capacity to transform their visions for society into reality and also empowers people to play their role in the society effectively. Education can transform a society through the transmission of knowledge. So, through ICT knowledge can be transferred to the individual for the better development of a society. ESD is a process of achieving sustainable development and it encompasses the three pillars: Society, Economy and Environment. UNESCO, as the lead agency spearheading the UNDESD (2005-2014), defines ESD as the promotion of values and ethics through education at different levels to make an impact on people’s lifestyles and behaviours and help build a sustainable future. Education for sustainability is seen as a vision and a mission of personal and social change and involves empowering all citizens to be leaders in the transition to a more sustainable future. Broadly speaking, the principal characteristics of ESD are:

• Interdisciplinary, systemic and holistic in approach;

• Values driven and empowerment;

• Focused on critical reflective thinking and problem solving;

• Multi-methodological;

• Participatory action-oriented; and

• Locally/globally relevant contents and contexts.

To achieve sustainable development, education is essential. Education literally means the process of imparting intellectual, moral and social skills and values to learners for particular purpose. Education and training are the key processes by which human beings and societies can reach their fullest potential. Education is the key to sustainable development. The education of today is crucial to enable the leaders and citizens of tomorrow to create solutions and find new ways to a better, more sustainable future. Education for Sustainable Development (ESD) is the way forward if we are to equip our young people to meet the environmental challenges of today and tomorrow.

 Education for sustainable development (ESD) is the acquisition and development of knowledge, skills, attitudes, and values that enhance participation in providing solutions to environmental challenges, thus making it possible to achieve development that meets the needs of the present without making the future generations fail to meet their own needs. Educating people for sustainable development should provide skills, perspectives, values and knowledge to live sustainably. Vare & Scott (2007) suggest, “Whether we view sustainable development as our greatest challenge or a subversive litany, every phase of our education system is being urged to declare its support for education for sustainable development”

**ROLE AND IMPORTANCE OF ICT IN EDUCATION**

A vibrant education sector is fundamental for developing human capital within countries. With an active and transformative education policy and a supportive infrastructure, the development of a knowledge-based population can apply itself to sustained and equitable growth. ICT can play a vital role in increasing access to education as well as providing better quality education. A study conducted by the International Institute for Communication and Development (IICD) indicated that 80% of its participants felt more aware and empowered by their exposure to ICT in education, and 60% stated that the process of teaching as well as learning were directly and positively affected by the use of ICT.

ICT can enable teachers to transform their practices by providing them with improved educational content and more effective teaching methods. Continuous teacher training in updating and enhancing their methodologies is critical to effective education policy and practice to keep pace with the constant advancement of technology. Through online teaching resources and other interactive educational materials, teacher development can be greatly improved.

ICT can improve the learning process through the provision of more interactive educational materials that increase learner motivation and facilitate the acquisition of basic skills. The use of various multimedia devices such as television, videos and computer software can offer a more challenging and engaging learning environment for students of all ages. Twenty-first century education reform policy has been focused on a shift from the traditional teacher-centered pedagogy to more learner-centered methods. Active, collaborative learning environments facilitated by ICT contribute to the creation of a knowledge-based student population.10 In addition ICT skills that come along with this shift in pedagogy are also useful for students hoping to transition into today’s job market, which in many countries is increasingly demanding these skills. Developing a critical mass of knowledge workers with proficient ICT skills will greatly improve long term economic opportunities.

Education leadership, management and governance can also be improved through ICT by enhancing educational content development and supporting administrative processes in schools and other educational establishments. By supporting management and reforming administrative procedures more effectively, ICT would serve as an incentive for leaders and staff at all levels to institutionalize its use. Clearly there is great potential for ICT to enhance education around the globe going forward.

**Increased Access to Education through ICT**

ICT is used worldwide to increase access to, and improve the relevance and quality of education. The unprecedented speed and general availability of information due to ICT extends educational opportunities to marginalized and vulnerable groups. ICT gives students and teachers new tools with which to learn and teach. Geographical distance is no longer an obstacle to obtaining an education. It is no longer necessary for teachers and students to be in the same space, due to innovations of technologies such as teleconferencing and distance learning, which allow for synchronous learning.6 If given access and appropriate training in ICT, the Internet can also provide these groups with an abundance of online learning materials, covering a wide range of subjects that are up-to-date and produced by cutting-edge technologies. Thus, teachers and learners are no longer solely dependent on physical media such as printed textbooks which are often times outdated especially in the developing world. With today’s technology, one even has the ability to access experts, professionals, and leaders in the field around the world at any given time.7In addition, many world-leading conventional universities are now offering some of their academic courses through various ICTs for their distant learners and have established themselves as dual mode universities. Applications and processes of e-learning include web-based learning, computer-based learning, virtual classrooms, and digital collaboration, where content is delivered via the internet, intranet/extranet, audio/ and or video tape, satellite TV and CD-ROM.8 Although many developing countries have begun to take initiatives to introduce virtual classrooms at their schools, the use of e-learning continues to be a challenge for the least developed countries.

**THE ROLE OF ICT IN EDUCATION FOR SUSTAINABLE DEVELOPMENT**

ICTs play an important role in advancing ESD in two ways:

1. By increasing access to educational materials about sustainability (e.g., via distance learning,

Educational networks and databases); and

2. By helping to promote new ways of interacting in order to facilitate the learning called for in

ESD, that emphasizes not just knowledge, but choices, values and actions.

**Current Uses**

Current uses of ICTs in ESD fall into two broad categories:

1. Information resources, tools and portals for educators;

2. Supplements to classroom-based activities;

 ***Information resources, tools and portals for educators***

It almost goes without saying that the Web provides extensive links to information on ICTs in

Education; platforms for educators to exchange knowledge, read and publish articles and lesson

plans and connections to support materials for ESD.

However, when looking specifically for research on the use of ICTs for Education for Sustainable Development, including educational policies, pedagogical approaches and classroom uses of ICTs for ESD, there is not much available to date. This may be because ESD has grown from the tradition of environmental/outdoor education, which aimed at getting learners outside to experience and learn about the natural world. Early proponents of the use of ICTs in education were from the civics fields—promoting media awareness activities (researching TV shows, Internet resources, etc.) and cultural understanding activities that use collaborative Internet technologies. However as educators from diverse disciplines are increasingly embracing ESD, more examples of ICT use for ESD are emerging.

***ICTs as a supplement to classroom-based activities***

ICTs applications are being designed to promote collaboration, connectivity, “real-world,”

experience- based learning, and systems thinking, which are emerging as key pedagogical methods conducive to educating for sustainability. Examples provided are from K–12 as well as in universities. The field of geography is one of the first where experts are increasingly using ICT tools as central to the curriculum, including Mapping and Graphics software, Geographic Information Systems (GIS) and Global Positioning Systems (GPS).

***Collaboration and connectivity***

There are many collaborative learning projects on the Internet. e- Pals is the self-proclaimed world’s largest K–12 online community, with more than 325,000 educators and 126,000 classrooms in over 200 countries and territories which “safely connect, exchange ideas, and learn together.”8 ePals provides blogging software and an e-mail program, live classroom collaborations and discussions, best-practice examples of classroom use, and tools for searching projects and connecting with classrooms and finding communities. It is being widely being used as a language and cultural learning tool. A similar set of tools, with the specific mission of “improving life on the planet” is iEARN (the International Education and Resource Network), a non-profit organization made up of over 20,000 schools and youth organizations in more than 115 countries. iEARN empowers teachers and young people to work together online using the Internet and other new communications technologies. Over 1,000,000 students each day are engaged in collaborative project work worldwide.

In the area sustainable development and environmental awareness, there is ENO-Environment Online, a global virtual school and network based in Finland, which has approximately 400 participating schools from 104 countries. Four environmental themes are studied within a school year on a weekly basis.

Interestingly, its communications platform is based on Google’s free suite of communication tools, including Google’s groups, maps, docs, e-mail and its “Talk” chat application. ENO’s learning activities include a youth forum for discussing SD issues; it uses a global tree planting campaign among schools as a unifying motivator; and applies a school “ twinning” model where schools from different countries partner up to learn about specific themes or work on projects together. Facebook, twitter and many other social networking sites are available which connects people worldwide. Though these sites cannot be termed as learning sites formally but these sites cannot be ignored as well when it comes to learning.

**PROSPECTS OF ICT FOR SUSTAINABLE DEVELOPMENT**

**Web site design***:* Young school leavers can be fully engaged in web design thereby bringing market information closer to the rural dwellers through the use of local language that is understood by the people.

**Programming**: Many Small and Medium Enterprise (SMEs) today employ the use of database in their daily business transaction. Young programmers can adequately earn a living by coding the programs that will run these SMEs.

**Maintenance**: One of the major requirements in the ICT world is the technical skill to service the computer and other ICT facilities. Youths can develop themselves in this area and then becomes self-reliant as they can even serve as consultants to the governmental and non-governmental organization

**Commercial Computer Outfits:** There is great demand for printed document in today’s society. Thus youth can empower themselves with the necessary computer skills that can make them self-employed in meeting this demand.

**Computer Training Centres:** young people are increasingly being engaged in the training of other youths (i.e. train the trainers) in acquiring computer literacy thereby getting their source of livelihood from running the training centres.

**Computer Networking:** this play an important role for easy and effective dissemination of information in industries, organization, institutions and almost all governmental parastatals. Hence, young generation can be empowered with IT skills on how to do computer networking.

**Cyber Café:** young men are being employed to manage various cybercafé throughout the world there by giving them job opportunities for self-reliance.

**Economic Sustainability**: ICT play an important role in sustaining the economy of a country. Through internet GSM, radio, television etc. Different transactions take place all over the world in 24 hours. With the use of credit card you can make transaction anywhere in the world without waste of energy and time. Banks also use ATM card for withdrawal of money in 24 hours. Therefore, the process of e-banking and e-commerce is very important in promoting the economic development of a country in the context globalization.

**Social Sustainability:** ICTs equipments give people access to listening and reading news as well as entertainment. It is possible to chart with a friend through internet both audio and visual. This is also applicable to GSM also allows teleconferencing (more than two people communicating at the same time).

**Political Sustainability:** This is the greatest weapon that politician use in doing their campaign. Television, radio and internet play very important role here. With these equipments they reach everybody in the whole world during campaign. Sophisticated software is used in casting and counting vote which minimize injustice during election. In fact, in the 2008 US election, Obama relied heavily for his success in the polls on the internet through which millions of dollars were collected as donations for his campaign.

**Enhancing Teacher Training:** ICTs have also been used to improve access to and the quality of teacher training. For example, institutions like the Cyber Teacher Training (CTTC) in south Korea are taking advantage of the internet to provide better teacher professional development opportunities to in-service teachers. The government funded CTTC, established in 1997, offers self-directed, self-paced web-based courses for primary and secondary school teachers. Courses include “computers in the information society,” “Education Reform,” and “future society and education.” Online tutorials are also offered, with some courses requiring occasional face-to-face meetings. In china, large-scale radio and television-based teacher education has for many years been conducted by the China Central Radio and TV University. (Carnoy, et al. 2001),

The shanghai Radio and TV University and many other RTVUs in the country. At Indira Gandhi National Open University, satellite-based one-way video-and two-way audio-conferencing was held in 1996, supplemented by print materials and recorded video, to train 910 primary school teachers and facilitators from 20 district training institutes in Karnataka State. The teachers interacted with remote lecturers by telephone and fax. (Carnoy, et al., 2001),

**Active learning:** ICT enhanced leaning mobilizes tools for examination, calculation and analysis of information, thus providing a platform for student inquiry, analysis and construction of new information learners therefore learn as they do and, whenever appropriate, work on real-life problems in-depth, making learning less abstract and more relevant to the learner’s life situation. In this way, and in contrast to memorization-based or rote learning, ICT-enhanced learning promotes increased learner engagement. ICT-enhanced learning is also “just-in-time” learning in which learners can choose what to learn when they need to learn it.

**Collaborative learning:** ICT-supported learning encourages interaction and cooperation among students, teachers, and experts regardless of where they are. Apart from modeling real-world interactions, ICT-supported learning provides learners the opportunity to work with people from different cultures, thereby helping to enhance learners’ teaming and communicative skills as well as their global awareness. In models learning done throughout the learner’s lifetime by expanding the learning space to include not just peers but also mentors and experts from different fields.

**Evaluative learning:** ICT-enhanced learning is student-directed and diagnostic. Unlike static, text-or print-based educational technologies, ICT-enhanced learning recognizes that there are many different learning pathways and many different articulations of knowledge. ICTs allow learners to explore and discover rather than merely listen and remember. Direct class teaching, where broadcast programming substitutes for teachers on a temporary basis; school broadcasting, where broadcast programming provides complementary teaching and learning resources not otherwise available, and general educational programming over community, national and international stations which provide general and informal educational opportunities.

**CHALLENGES OF ICT FOR PROMOTING SUSTAINABILITY DEVELOPMENT**

ICT is one of the tools that used in promoting sustainability development in both developed and developing countries. Nevertheless, there are some challenges facing the integratio0n of ICT effectively. The significant challenges are outline below: **Lack of Maintenance Culture:** ICT facilitate needs regular maintenance in other to sustain it maximum life span: But unfortunately, most of the developing countries neglect maintenance culture and this seriously affects ICT equipments.

**Lack of Time and Resources:** Staff lacking the time to deal with the challenges of sustaining ICT facilities, which is time-consuming. IT departments already face increasing demands from their institutions, without a commensurate increase in staff. Many of the programming changes required to implement sustainable ICT require considerable technical skill to implement. This constraint will become less pressing as staff becomes more familiar with the issues.

**Budgetary Constraints:** Many government parastatals and tertiary institutions feel they are under-funded, and lack of capital budget means there is no enough money to spend on sustaining ICT facilities and activities. Most capital budget for ICT has to be spent on activities that contribute to immediate goals. Universities and colleges are further disadvantaged because they misused priority in their dealings. Savings from energy efficiency measures will result in lower operational costs, but normal budgeting systems make it difficult to transfer money saved from operational costs to a capital budget

**Lack Information and Guidance:** Because the issue of sustainable ICT is relative new, many people, particularly teaching and research staff, do not know where they can find relevant information and guidance about. Especially confusing is the fact that a number of vendors claim that their products are “green”. A common problem is that much of the ICT equipment used in the institution is not owned by the IT department, so it is hard to carry out an audit of what is owned by whom, and how energy-efficient it is. The situation is exacerbated by the lack of standardized metrics to assess the energy efficiency of ICT equipment.

A good understanding of the energy consumption association with specific computer tasks is a prerequisite for better management, but without this kind of information it is difficult to set targets for, and therefore to measure the success of sustainable ICT projects.

**Infrastructure-related Challenges:** Before any ICT-based programme is launched, policymakers and planners must carefully consider the following:-

* Appropriate rooms or buildings should be available to house the technology? Proper buildings extensive retrofitting to ensure proper electrical wiring, heating/ cooling and ventilation, and safety and security are highly needed.
* Another basic requirement is the availability of electricity and telephony. In developing countries large areas are still without a reliable supply of electricity and the nearest telephones are miles away.

**CONCLUSION**

It is clearly showed that ICT play a vital role in sustainable development for both developed and developing countries. Consequently, recommendations were made for minimizing some of the challenges attributed to the implementation of ICT facilities. In conclusion, government and any other stake holders must take necessary measures on proper implementation of ICT facilities in order to achieve goals and objective of sustainable development.

 A rigorous analysis of the present state of the ICT in education system, ICT-based interventions must take into account and its current institutional practices and arrangements. Specifically, drivers and barriers to ICT use need to be identified, including those related to curriculum and pedagogy, infrastructure, capacity-building, language and content, and financing.

The specification of educational goals at different education and training levels as well as the policymaker and understanding of the potentials of different ICTs when applied in different contexts for different purposes, and an awareness of priority education needs and financial and human resource capacity and constraints within the country or locality, as well as best practices around the world and how these practices can be adapted for specific country requirement should be taken in account.

 The specification of existing sources of financing and the development of strategies for generating financial resources to support ICT should use over the long term and Government should provide adequate fund for ICT facilities maintenance.

 ICT is very important in education for sustainable development as this 21st century is an era of science and technology. So to facilitate education for sustainable development the knowledge and the utilization of ICT becomes necessary for the upliftment and progress of an individual as well as for the society. And when society gets uplifted the nation will itself flourish.

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