

The Role of ICTs in Sustainable Development: Perspectives from an Emerging Economy

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Abstract:- Information and Communication Technologies (ICTs) have become an essential tool for sustainable development. The use of ICTs in various sectors of the economy has brought about significant improvements in the quality of life, economic growth, and environmental sustainability. This paper proposes that using ICTs to drive sustainable development offers more benefits than negative consequences although acknowledging that like all successful projects, proper and efficient utilization of methods are important to success. Therefore, when advancing sustainable development, ICTs must be regarded as a tool used appropriately to achieve desirable outcomes. This paper presents a socio-economic perspective, subjective to developing economies realities, to this discourse. The paper discusses various views and conceptual frameworks put forward in the discussion of roles of ICTs in sustainable development. An optimistic and a pessimistic view of ICT with regard to sustainability, the three-pillar approach to sustainable development, the three-level approach to ICT impacts, the claim of human, social and ecological compatibility of ICT and the plain use of ICT for development. The paper shows that each of these approaches has its problems and limitations and conclude with formulating the challenges of finding an analytical approach which will effectively support decision-makers in using ICT in the service of sustainable development. In doing this, this paper examines the role of ICTs in sustainable development, the benefits and challenges of using ICTs, and the policy implications for developing countries.

Keywords:- ICTs; Sustainable Development; Emerging Economies;

I. INTRODUCTION

Realistic Sustainable Development requires the balancing of how individual human needs are satisfied and how well nature and its resources are preserved while satisfying these needs. This is not necessarily an easy equilibrium to achieve. However, without it, sustainability may not be achieved. We have seen tremendous advances in the role of e-government, especially regarding the creation and provision of public value to citizens [1]. It is not easy to determine and master the complexities surrounding socio-environmental and socio-cultural challenges which are prevalent in emerging economies, but sustainability is impossible without fully understanding and addressing these challenges comprehensively.

Sustainable development is a concept that has gained global attention in recent years. The United Nations defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It is a complex and multifaceted concept that requires a holistic approach to address the economic, social, and environmental challenges facing societies. Information and Communication Technologies (ICTs) have emerged as an essential tool for sustainable development, offering numerous benefits and opportunities to improve the quality of life for people around the world.

A fundamental concern to ICT supporting sustainable development is the recognition of the existing challenges in ICT itself and how well these demands can be resolved to socio-economic growth and sustainable development. The use of ICTs in sustainable development offers numerous benefits, including increased efficiency, improved access to information and services, and enhanced communication and collaboration. However, there are also challenges associated with the use of ICTs, including the seemingly increasing digital divide, privacy and security concerns, and the potential for negative environmental impacts. This implies that activities such as e-commerce, e-business, and e-government all support cross-national collaborative endeavors. Therefore, governments and enterprises alike can gain from these activities and proffer solutions to their own local and/or national challenges. Although socio-cultural idiosyncrasies may pose issues, sustainable initiatives need international cooperation, coordination, and standardization. International organizations, development partners and multinationals hold many answers in this regard in how to proceed. Another concern in achieving sustainable development through ICT is the natural human resistance to change. People usually oppose changing from their comfort zone to exploring new things and ideas.

ICTs play a critical role in sustainable development by providing access to information, promoting economic growth, and enhancing social and environmental sustainability. In the economic sphere, ICTs have revolutionized the way businesses operate, enabling them to increase productivity, reduce costs, and reach new markets. They have also provided opportunities for entrepreneurship and innovation, creating new employment opportunities and promoting economic growth. In the social sphere, ICTs have facilitated access to education, health care, and other basic services, particularly in rural and remote areas. They have also enabled social

networking and collaboration, providing opportunities for people to connect and share knowledge and information. In the environmental sphere, ICTs have enabled the monitoring and management of natural resources, helping to reduce environmental degradation and promote sustainable development. Examples of these 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 remotely 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. 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 their 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 Nigeria, use technology to enhance elementary education and computer literacy among poor children. Grassroots businesses in Nigeria are using the Internet to sell their produce through an auction system. They 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 programs [2].

II. LIMITATIONS OF TECHNOLOGY TO SUSTAINABLE DEVELOPMENT

The major limitation with technological advancements and implementations is in the perceptions that technology in itself is a problem solver. Development is a social and human challenge and technology itself cannot solve this challenge, but must be seen as a willing tool to be implemented in human development. Humans have a major role in determining the outcome of their lives and livelihood and must not be seen to be pawns awaiting their fate to see how technology bring them out of poverty and improve their standard of living.

The relationship between technological artifacts and the society that creates and interprets them is a complex one: Technologies interact with our perception of the world, which again influences how we use and develop technologies. In this process both symbolic and structuring aspects of technologies play a role, as in [3] describe: "...technology not only has a socio-cultural semantic effect (influence on social life) but also an effect on the subject's world experience (it influences the perception of the world and what the individual

understands this to be)." Consequently, using technologies influences needs, values, beliefs and other social realities that provide the context for the further development and application of technologies.

From this view of technologies as being embedded in societal development, it follows that solutions to the sustainability dilemma will not be technical solutions but predominantly social and anthropological ones. As far as technology is concerned, the chief of which is ICT, it can only be instrumental as part of a more comprehensive approach, being embedded in national and societal frameworks.

III. CONCEPTUAL FRAMEWORKS FOR ICT AND SUSTAINABLE DEVELOPMENT

A conceptual framework for an analytical approach to the relationship between ICT and sustainable development first has to change the prevailing perception of the concept of sustainable development. A very common idea is the well known three-pillar or three-dimensional approach to sustainable development, breaking down the concept into an ecological, a social and an economic dimension.

Although this three-dimensional approach may serve as a starting point for the discourse, it does not provide a philosophical or theoretical foundation for analysis. At best it can be seen to provide a methodological approach by which analysis of sustainability for development can be discussed.

Conceptual frameworks for "ICT and sustainable development" that go beyond this approach are briefly discussed in the following sub-sections. None of these frameworks claims to provide a comprehensive solution. Rather, they may be viewed as components to be included in a more comprehensive approach that can be formulated.

IV. THREE LEVELS OF ICT EFFECTS ON DEVELOPMENT

This approach focuses on applications of ICT and considers its resultant effect(s) on the environment. The three levels cover environmental impacts ranging from the most direct effects, physical effects of using the hardware, to the most indirect effects such as the influence of ICT on economic structures and lifestyles [4]:

- First-order effects: Includes all environmental impacts resulting from ICT hardware during the product lifecycle, covering production, use, and disposal."
- "Second-order effects: The use of ICT causes effects to other processes such as traffic or industrial production and influences their environmental impacts indirectly."
- "Third-order effects: Owing to the assumed widespread use of ICT in everyday life, economic structures and lifestyles can change, indirectly affecting the expression of first- and second-order effects."

The three-level approach is very common in research on environmental impacts of ICT, although it could be generalized to the effects on social systems, including the economic system [5].

V. HUMAN, SOCIAL AND ECOLOGICAL COMPATIBILITY OF ICT

The German Informatics Society set up a working group named “Sustainable Information Society” to clarify the opportunities and risks of ICT for sustainable development over a decade ago. The group produced a detailed memorandum that was published as a Fraunhofer IRB book in German with an English abstract [6] and summarized in international publications [7] [8].

The approach taken by the working group has two essential features. Firstly, it builds upon the three-level approach described in the previous section by redefining the levels as follows:

- “effects of supply”: effects of the effort necessary to provide people with information and communications services, including the production of ICT hardware and software, supplying the energy and other resources to use ICT, and the end-of-life treatment of the hardware.
- “effects of usage”: effects of services provided by ICT viewed in the restricted context of the application, such as substitution or optimization effects.
- “systemic effects”: long-term effects that have to be taken into account, mainly because positive effects of usage may backfire in the economic system (rebound effects).

VI. LIMITATIONS OF TECHNOLOGY TO SUSTAINABLE DEVELOPMENT

The working group emphasized that steps toward a sustainable information society cannot be based on technological measures alone, [4] stated that “This is partially due to the so called rebound effect, according to which a transition to more efficient technologies causes an expansion of activities given constant financial and time budgets.” This is seen to be a major contributor to the digital divide as resources, both financial and human capital, are not equitably distributed and as such those with more resources available tend to develop at a more rapid rate than those with limited resources available.

The second feature of this approach is that it explicitly replaces the “three-pillar thinking” of weak sustainability with the concept of three nested subjects of protection: the human individual as part of society, which is embedded in nature. From these subjects of protection, the working group derived three claims of compatibility: human, social and ecological compatibility. Combining this idea with the three levels of ICT effects yields nine fields of research and societal discourse that should be considered if ICT is to support sustainable development.

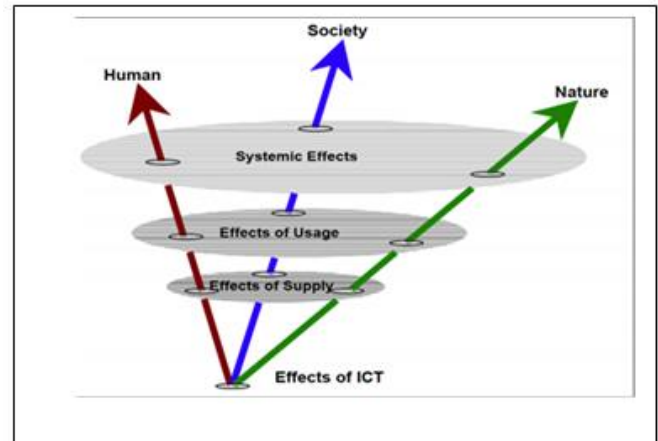


Fig 1 The conceptual framework created by the working group “Sustainable Information Society” of the German Informatics Society in 2004

VII. ICT FOR DEVELOPMENT

This prominent approach differs from the two previously presented approaches by its simplicity. It ignores the sustainability dilemma by putting the emphasis on intra-generation national justice i.e., meeting the needs of the present. ICT is seen as a vehicle to empower the poor and enable development in underdeveloped regions of the world. The overuse of natural resources is implicitly expected to be reduced, rather than, increased by economic growth in poor countries.

This approach presupposes that statistically, population growth is negatively correlated with the education of young women. If it is true that ICT can successfully be applied in educating the poor, ICT would then indeed contribute to sustainable development. However, the digital gender divide seems to put this presumption in jeopardy. Research is still on going to determine if indeed bridging of the digital gender divide statistically contributes to improvement in socio-economic development as against focusing on improving literacy rates across all demographics including adult education.

Mobile technologies and the potentials therein to surmount the access to educational technologies challenges are no doubt far reaching. Hitherto disenfranchised communities now have access to information about literally everything at their fingertips. Improvement in internet penetration rates have also mitigated against some of the predominant challenges faced by emerging economies in implementing technological initiatives.

VIII. POLICY INITIATIVES

Although grasping the phenomenological interrelationships and interconnectedness concept between sustainability and development may be difficult, the necessity of understanding its reality cannot be overemphasized. Societies need collaboration and sharing of ideas, experiences and resources to grow and thrive. Without such cooperation, the three fundamental characteristics of sustainability: environmental, economic, and societal responsibilities will not

materialize [9]. Organisations and governments alike must therefore enact initiatives and policies that build societies and communities that are “economically efficient, socially equitable and ecologically viable” [10]. In the absence of these key factors, sustainability may prove unachievable.

Societies constantly evolve. The digital impact on such dynamism must therefore be factored in terms of its impact on daily life and how people choose to use technology in all aspects of their lives. Sustainability must be seen as a strategic endeavor, and must be planned for, in the face of rapid technological advancements across countries and cultures. In this regard, sustainable development must go beyond usage of technology for basic things such as using cell phones merely to chat, but should include enriching data services for more complex daily activities such as banking, commerce, education, healthcare and other viable services.

Policy Initiatives 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.

Emerging economies face unique challenges in harnessing the benefits of ICTs for sustainable development [11]. They must overcome the digital divide, build the necessary infrastructure, and develop appropriate policies and regulations. Governments, civil society organizations, and the private sector all have a role to play in promoting the use of ICTs for sustainable development.

IX. CONCLUSION

There are challenges to using ICT as the driving force for sustainable development. However, ICT potentially provides its greatest hope. This paradox cannot be ignored and must be assessed in the context of modernity and the role that ICTs play in the contemporary context of modern societies. ICT advances “economic, social, cultural, and political” initiatives in ways that affect all stakeholders positively when done correctly (Singh, n.d). To this extent, emerging economies can use ICT to their advantages. ICT can bring public value of government institutions to remote regions by leveraging on technology to reach hitherto disenfranchised communities.

The use of ICTs in sustainable development offers significant opportunities to address the economic, social, and environmental challenges facing societies. However, realizing these opportunities requires a holistic and collaborative approach that takes into account the unique challenges facing developing countries. Governments, civil society organizations, and the private sector must work together to build the necessary infrastructure, develop appropriate policies and regulations, and promote equitable access to ICTs. By doing so, we can harness the power of ICTs to create a more sustainable and prosperous future for all.

However, we must remember that ICT is in itself just a tool. A tool that should be used to promote equitable distribution of socio-economic growth. Sustainable development through ICT initiatives is therefore a reality that needs only to be embraced by those who realistically demand that societies are more equitable.

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