Original Article

Green ICT Opportunities in Economic Sector in Tanzania

Tumaini Meckphason Makundi[1], Moses Nzuki Mwendwa[2], Franklin Wabwoba[3]

Department of Information Technology, Kibabii University, Bungoma, Kenya

Abstract - *Information and communication technologies (ICTs) are quickly expanding and significantly impact all sectors, whether directly or indirectly. Globally, there is a positive attitude toward their expansion, as evidenced by Tanzania's support for economic development innovation to achieve substantial results. ICTs are both allies and foes in terms of the environment. Concerns over this trend prompted national and international organizations to push the notion of green information and communication technologies. This attempts to improve ICT efficiency and effectiveness by reducing or eliminating negative environmental consequences. This study aimed to examine the Green ICT opportunities in the economic sector in Tanzania. The researcher applied a descriptive research design and a desktop review to gather the information.*

Keywords - Green ICT, Green ICT Opportunities, ICT Opportunities in Economy.

1. Introduction

ICTs may add to national GDP and enhance the market competitiveness of a country's goods and services, as shown by case studies from various countries. Organizations across domains strive to improve their business agility using ICTs [1]. ICTs also positively influence a country's governance, promoting international economic integration, raising living standards, reducing inequality, and improving natural resource usage. Because ICTs may assist developing nations, like Tanzania, make up for what they lack in industrial resources by catching up to the industrialized world in terms of information, they are crucial in improving economic progress in the 21st century.

This significance is evident in the fact that most nations now have national "e-strategies" in place, and donor agencies regularly invest in them. ICTs help to progress economically in underdeveloped nations in primarily two ways. One is via their production, and the other is through their application. ICTs necessitate manufacturing since they are made up of numerous technical entities. The majority of this production is outsourced to developing countries by wealthy nations.

Establishing manufacturing hubs and industries in developing nations entails paying taxes to these countries, contributing directly to their GDP and GNP. It is also clear that companies, particularly ICT sectors, are not stand-alone entities but rather part of a wider value chain. As a result, as mentioned earlier, the effects are not restricted to one area but spread out to numerous sectors, all of which contribute to a country's economic growth simultaneously. Then there's the purchasing and selling process. ICTs, regardless of where they are manufactured, frequently make their way into developing-country marketplaces, where they are bought and sold. Depending on the size of the market, this simple act of trade yields millions of dollars in revenue for governments. Economic growth is the source of this money. This is how the physical features of ICTs assist developing countries in achieving economic progress.

The intricacy of the connection is apparent when it comes to the impact of ICTs on the environment. It is evident in the direct link that exists due to the widespread usage of hardware and software throughout the world and their impact on nearly every other aspect of activity and social life. According to research conducted by many experts in both developed and developing nations, the rising number of users of ICT goods ultimately leads to a rise in negative environmental impacts (pollution, irrational consumption of non-renewable resources and increase in the volume of non-degradable waste). While rich nations have stringent environmental rules, developing countries have various legal flaws or violations.

Regardless of geographic location, country size, culture and civilization level, environmental issues remain a societal obligation. Economic status cannot be used as an excuse for a shallow approach to this critical part of human existence. As a result, each country's policies continue to be a contentious issue of national and international discussion. ICTs are efficient enough for the environment and do not have negative consequences in areas where green ICT is being implemented.

2. Literature Review

2.1. ICT in Tanzania's economy

The information and communication technologies (ICTs) utilized to assist economic growth to differ from one company to the next. While some businesses use modern ICT tools, others rely on more basic ones. Businesses use computers, networks, the Internet, and a variety of software packages to run their operations [2]. It is undeniable that information and communication technologies (ICTs), such as personal computers and the Internet, are widely used in businesses of all kinds [3]. Surprisingly, just a handful of the papers analyzed mentioned mobile phones as instruments for improving corporate operations and creativity. Mobile phones, in reality, are multi-purpose communication tools that help numerous businesses with their business processes [4]. The importance of ICTs in

business may be compared to the importance of engine oil in sustaining and maintaining motion. ICT usage, like an engine, accelerates a company's growth and aids in the change of business models [5]. In addition to productivity, ICTs are an important component in promoting the diversity of corporate operations [6]. Understandably, using ICTs in business operations has been found to favour various business activities, including process and organizational-related tasks [3].

In reality, the influence of ICT on economic development may be assessed along the dimensions of a company's goods and operations. ICTs were also identified by [7] as a source of new solutions for competitive company development. In other words, information and communication technologies (ICTs) are critical in achieving long-term business success. The manner in which ICTs assist business operations is one of the indisputable contributions. ICTs allow the development of new and improved ways to grow markets and improve performance [7]. ICT adoption and application create chances for organizations to discover creative solutions for processes and product management, helping them to survive in competitive marketplaces [6]. ICTs also promote other technologies, boosting corporate operations such as product production. When it comes to business models, ICTs play a critical role in ensuring that all models, such as business-to-business (B2B), business-to-consumer (B2C), and supply chain management (SCM), work effectively [3].

Recognizing the importance of ICTs, Tanzania's government has implemented reforms and policies to promote various projects to increase the use of these technologies in many sectors. The Tanzanian government, for example, has adopted and implemented an ICT Policy Framework since 2003, which was later amended in 2016. ICTs are a driving factor for achieving socio-economic progress in all areas, according to the policy. The National ICT Policy 2016 aims to implement measures and mechanisms to increase broadband penetration and access, strengthen ICT security and standardization, improve spectrum management and efficient utilization, promote the outsourcing business process industry, and improve e-service and business efficiency.

Aside from legislation, the government's dedication to this cause is demonstrated by its financial investment in ICT-related initiatives [8], such as building broadband infrastructure to improve communication services in the country [3]. These activities are part of the endeavor to accelerate poverty reduction and meet the National Strategy for Economic Growth and Poverty Reduction (NSEGPR) goals and the National Development Vision 2025 [9].

Despite the government's attempts and reforms to encourage the use and application of ICTs in all sectors, commercial enterprises have reported sluggish acceptance and implementation of these technologies. The use of software, for example, has been shown to be minimal in all sorts of businesses, regardless of size. In contrast to medium and large businesses, the use of Internet services to improve company performance is low in small businesses. In terms of computer utilization, organizations of all sizes have been shown to use these technologies to assist their operations [3].

2.2. Green ICT opportunities

ICT is widely used as a "general purpose technology" or an "enabling technology" in various fields and considerably impacts the entire economy. Information and communication technology (ICT) is becoming more widely employed in business, and it is progressing toward more advanced and sophisticated applications. The role of information and communication technology (ICT) in economic growth is widely acknowledged, especially in terms of innovation, competitiveness, and long-term viability.

The three regions are intertwined intimately. Increasing a company's energy efficiency ("sustainability"), for example, decreases costs and improves its competitiveness. However, there may be conflicts of interest between these domains: Spending on green technologies may increase environmental sustainability, but it will not pay off for the company in the long run [10].

At various levels, such as the micro level of a single firm, the meso level of an industry, and the macro level of the economy, sustainability, competitiveness, and innovation are all essential features of the ICT effect. For years, affluent countries' industrial and innovation policies have concentrated on ICT because of the meso and macro impacts.

In recent years, a new aspect of ICT usage has become a focus of attention: ICT's "green" potential, or its use to become more energy-efficient and, as a result, lower greenhouse gas emissions. There is a lot of optimism that information and communication technology (ICT) will significantly tackle climate change and other environmental challenges [11].

In the last 5–10 years, there has been a universal consensus that information and communication technologies (ICTs) may assist the economy in three ways [12].

- By improving energy and materials efficiency, increasing the use of renewable energy sources, reducing the use of toxic materials, and improving recycling and end-of-life disposal of ICTs, we can reduce the direct effects on the environment from the production, distribution, operation, and disposal of ICTs.

- By enhancing the enabling effects of ICTs on the development of the green economy through increased efficiency in the production, distribution, and consumption of goods and services throughout the economy and society; by reducing demand for energy and materials through the whole or partial substitution of virtual products and services for their physical equivalents [13] and by dematerializing human activities and interactions

- Promoting systemic impacts leads to changes in citizen and consumer behavior, attitudes, and values, as well as economic and social structures and governance processes. In collaboration with other sectors, the ICT industry can play a critical role in making society's influence evident and demonstrating the desire for new solutions to reduce that impact.

2.3. Green ICT in Tanzania's economy

Due to recent climate change, the progress of information and communication technologies has collided with environmental conservation, resulting in the emergence of ideas such as green ICT, ecological informatics, green computing, and ICT sustainability. They all refer to the development and usage of hardware and software in accordance with environmental regulations and those attempting to monitor the environment and apply specific legislation developed by national and international organizations, regardless of their shape or name [9].

In Tanzania, green ICT provides economic benefits, and the economy can grow in the following ways:

- **Electricity bills are reduced as a result of this**. Green computing usage in the economic sector can assist save a substantial amount of energy over time, which is a big benefit. Many businesses and organizations are still inefficient, and there is still space for energy savings. Green IT, which tries to reduce energy usage by making IT processes more efficient, might be a fantastic method to attain a more energy-efficient computing environment [9]. Because servers consume enormous quantities of energy worldwide, it is vital to reduce worldwide computer energy consumption to reduce global energy demand and improve our environmental impact.

- **Green ICT can save money**. Industries and organizations can save money by implementing green IT systems to save energy [14]. It will aid economic growth by allowing them to expand their business more easily.

- **Recycling methods are more advanced**. Making aging computers and other devices more recyclable is another essential part of green computing. A sophisticated method of segregating electronic waste could be one example [9]. It could also imply employing more biodegradable materials instead of plastics to reduce the environmental impact of electronic gadget trash.

- **Reduction of waste.** If the economic sector adopts green IT practices, more electronic trash will be suitable for recycling, and less garbage will need to be disposed of in landfills or burned. Furthermore, green ICT attempts to enhance recycling and waste products in the first place [11]. It could indicate, for instance, that computers and other hardware are being used for extended periods.

- **Reduction of the problem of resource depletion**. Because we are now consuming an excessive quantity of fossil resources as a species, green IT allows us to mitigate the problem of resource depletion. However, we may run out of those resources in the not-too-distant future, resulting in greater costs and a myriad of additional concerns [12]. As a result, it is vital to protect our natural resources. The economic sector can grow quickly if resources are conserved.

- **Pollution is reduced.** The production of IT hardware generates a lot of pollution of various kinds. For example, various toxic gases are released into the air during the manufacturing of material items, leading to air pollution, smog, and particle pollution. Furthermore, because some electronic trash will be disposed of in landfills, dangerous compounds in the waste may poison the soil and eventually enter groundwater [15]. As a result, green computing could be a wonderful solution to minimize the pollution [16] issues associated with traditional computing to some level.

- **Reduction of greenhouse gases emission**. Large amounts of greenhouse gases are discharged into the environment during the production of computers and other gear. As a result of the emissions of such gases, the problem of global warming will be aggravated. As a result, green computing methods must be implemented to use our computers and other devices for longer periods while using fewer hardware components and emitting fewer greenhouse gases into the atmosphere [15].

- **Increases pressure on to green IT industry.** The growing popularity of green computing [17] is placing pressure on the whole, IT industry. Others may feel forced to follow suit as more organizations shift to more sustainable IT infrastructures to improve their image. As a result, green computing can hasten the IT industry's shift from traditional to environmentally friendly computing methods in a relatively short time, which would be tremendously helpful to both the environment and the economy[18].

3. Methodology

The resources for the study were gathered through a desktop review. Other studies, grey literature, and policy publications connected to the subject were included in the search lists, which were confined to English only. Google Scholar and social sciences Abstracts, PubMed, and ResearchGate, are among the data sources. The article's reference section was utilized to locate additional references not found by the first search engines. Green ICT, Green ICT Opportunities, and ICT Opportunities in the economy were utilized as search phrases. Data was gathered from articles on ICT and Green ICT. In addition, the study draws on the findings of other related recent studies conducted by other authors, and the study presents the findings following the study's aims.

4. Findings

Although current policymaking and industry initiatives remain focused on ICT greening, global trends study found that a rapid acceptance of greening with ICT [19] as an enabler of economic growth can be expected (reducing the environmental impact of ICT). Only a few practical policy initiatives have been done in the area of green ICT as a driver of economic growth so far. According to the survey, Tanzanian businesses are innovative and constantly innovate to make their products, services, or business operations more efficient and environmentally friendly. The majority of the items and services found are software and advisory services. Complex systems often incorporate multiple components that rely on third-party hardware purchased from outside. As a result, successful solution creation necessitates effective cross-border collaboration in product development and marketing. Typically, product and service developers do not limit their goals to the Tanzanian market and are keen to expand into other countries. According to the findings, Tanzania's corporate climate is somewhat innovative and receptive to considering goods, solutions, and procedures that could lead to enhanced efficiency and reduced environmental impact. The following are some of the challenges that are preventing Tanzania from progressing in the adoption of green ICT and solutions:

- Most Tanzanian stakeholders do not see green ICT as a viable solution for increasing energy, material efficiency, and environmental friendliness [20]. Even if they do, knowledge is scarce regarding the potential of green ICT or the use of ICT to green business processes and products.
- Uncertainty about benefits: Companies on the demand side aren't very good at assessing different products and solutions based on their environmental impact and resource and energy efficiency.
- There is a lack of collaboration. The smooth and rapid development and implementation of ICT-based solutions [21] for improving energy and material usage efficiency and environmental friendliness require cross-sector cooperation between companies, enabled by the public sector and supported by academic research and development organizations.

A shortage of helpful resources. Tanzanian firms rarely have internal resources for development; nevertheless, by diverting resources into the industry, the public sector could foster innovation in the field and accelerate the creation and adoption of green ICT products and solutions.

5. Conclusion

ICTs are pervasive in the global economy and social life, and their benefits are undeniable [22]. Widening production and consumption should only be done while keeping a close eye on the short- and long-term consequences on ecosystems and the overall impact on the environment to guarantee that greener ICTs are chosen. Unfortunately, there are many situations where this vital aspect of human life has been overlooked to create suitable conditions for rapid economic growth [23]. Economic development is a significant source for both the production and consumption of hardware and software. The population's mentality, which is less responsible for environmental effects, has favored an excessive development of this field of activity, ignoring the long-term consequences [24]. Tanzania's benefits attract ICT manufacturers, including cheaper labor costs, liberal regulation, fewer taxes, etc. Their purpose is to achieve rapid economic growth. Pollution, increasing waste, and non-renewable resource consumption are among the most serious environmental consequences. In addition, ICT consumption in Tanzania expanded dramatically due to greater access to certain products and services and higher demand resulting from increased production. It would be perfect in terms of economic growth through the expansion of ICT and adopting modern manufacturing methods that are less harmful to the environment. It would also be great if they focused on encouraging innovation in developing green products and services, especially when the environment is seen as critical not just for the current generation but also for future generations.

Recommendations

The proposals could be used to overcome the roadblocks to green ICT product and solution development and uptake. The recommendations are to take the following steps to raise company and entrepreneur knowledge of green ICT and enhance demand for and supply of associated products, services, and solutions:

- The creation of a database of useful green ICT goods and solutions [23] and have been demonstrated to be effective in greening corporate processes.
- Business consultation on the possibilities and best practices of clean technology and green ICT.
- The Green (ICT) Company Award recognizes and inspires businesses [25].

References

[1] Naga M. G, "Enterprise API Transformation: Driving towards API Economy," *International Journal of Computer Trends and Technology*, vol. 70, no. 6, pp. 44-50, 2022. *Crossref,* https://doi.org/10.14445/22312803/IJCTT-V70I6P105

[2] Hagsten E. and Kotnik P, "ICT as Facilitator of Internationalization in Small - and Medium-Sized Firms," *Small Business Economies,* vol. 48, no. 2, pp. 431-446, 2017. DOI: [15].[15]07/s11187-016-9781-2

[3] Mwantimwa K, "ICT usage to Enhance Firms' Business Processes in Tanzania," *Journal of Global Entrepreneurship Research,* vol. 9, pp. 1-23, 2019. *Crossref,* https://doi.org/[15].1186/s40497-019-0170-6.

[4] Justinian A, "*ICT for Fostering Industrialization and Socio-Economic Development in Tanzania*," A Paper Presented at 15TH Annual Engineers day at the Dr. Jakaya Kikwete Convection Centre – DODOMA, Conference Proceedings, 2017.

[5] Naga M. G, "A Framework for Successful Corporate Cloud Transformation," *International Journal of Computer Trends and Technology*, vol. 70, no. 3, pp. 9-15, 2022. *Crossref,* https://doi.org/[15].14445/22312803/IJCTT-V70I3P[15]2

[6] Díaz-Chao Á, Sainz-González J & Torrent-Sellens J, "ICT, Innovation, and Firm Productivity: New Evidence from Small Local Firms," *Journal of Business Research*, vol. 68, pp. 1439-1444, 2015. *Crossref,* https://doi.org/[15].[15]16/j.jbusres.2015.01.030

[7] Mário Franco & Maria Garcia, "Drivers of ICT Acceptance and Implementation in Micro-Firms in the Estate Agent Sector: Influence on Organizational Performance," *Information Technology for Development*, vol. 24, no. 4, pp. 658-680, 2018. *Crossref,* https://doi.org/[15].[15]80/02681[15]2.2017.1379378.

[8] Sisodiya R. & Mannepalli P. K, "A Survey on Social Digital Data-Based Sentiment Mining Techniques and Feature," *International Journal of Computer Trends and Technology*, vol. 69, no. 4, pp. 34-38, 2021. *Crossref,* https://doi.org/ [15].14445/22312803/IJCTT-V69I4P[15]7

[9] Wabwoba F, "Green ICT Policy Maturity for Actualization of Sustainable Computing in Developing Nations," *International Journal of Computer Science, Engineering and Information Technology (IJCSEIT)*, vol. 9, no. 3, pp. 1-13, 2019. *Crossref,* https://doi.org/[15].5281/zenodo.3271136

[10] Juan Jung & Enrique López-Bazo & Matteo Grazzi, "*Internet and Enterprise Productivity: Evidence from Latin America*," IREA Working Papers 201709, University of Barcelona, Research Institute of Applied Economics, 2017.

[11] Wabwoba F. and Mbugua S, "*Green ICT Implementation in Developing Nations: Personnel Perspective*," Scholars Press, 2014.

[12] Otieno B., Wabwoba F. and Shikhuyu J, "A Review of Green ICT Readiness in the Insurance Industry in Developing Nations," *The International Journal of Science & Technoledge,* vol. 7, no. 4, pp. 42-53, 2019. *Crossref,* https://doi.org/[15].24940/theijst/2019/v7/i4/ST1904-016

[13] Nadikattu R. R, "Data Warehouse Architecture – Leading the Next Generation Data Science," *International Journal of Computer Trends and Technology*, vol. 67, no. 9, pp. 78-80, 2019.

[14] Enyinnah C., Omotosho O. J. and Ogunlere S. O, "Enhanced LSTM Model for Data Center Energy Consumption Forecast," *International Journal of Computer Trends and Technology*, vol. 70, no. 4, pp. 29-33, 2022. *Crossref,* https://doi.org/[15].14445/22312803/IJCTT-V70I4P[15]5

[15] Laura-Diana Radu, "Green ICTs Potential in Emerging Economies," *Procedia Economics and Finance,* vol. 15, pp. 430-436, 2014. *Crossref,* https://doi.org/[15].[15]16/S2212-5671(14)00473-0

[16] Deepinder K., Kamaljit K, "Reliable Energy Efficient Clustering Scheme Analysis Using Mobile Sink in Wireless Sensor Networks," *International Journal of Computer Trends and Technology (IJCTT)*, vol. 4, no. 8, pp. 2589-2594, 2013.

[17] Verma P, "Effective Execution of Mergers and Acquisitions for IT Supply Chain," *International Journal of Computer Trends and Technology*, vol. 70, no. 7, pp. 8-15, 2022. *Crossref,* https://doi.org/[15].14445/22312803/IJCTT-V70I7P[15]2

[18] Raftree L, "ICT Opportunities and Barriers for Youth in Developing Countries," *UNICEF Office of Research – Innocenti*, 2018. [Online]. Available: https://www.unicef-irc.org/article/[15]09-ict-opportunities-and-barriers-for-youth-in-developing-countries.html

[19] Thananjeyan S. and Fernando M.S.D, "Analysis of Greening of Information Technology Systems in IT Organizations in Sri Lanka," *International Journal of Computer Trends and Technology (IJCTT),* vol. 28, no. 3, pp. 153-159, 2015.

[20] Shuaibu I., Musefiu A. and Magaji I, "Design, Simulation and Optimization of a Hybrid Renewable Energy System for Bayero University Kano, Nigeria," *International Journal of Computer Trends and Technology*, vol. 67, no. 15, pp. 73-80, 2019.

[21] Bahssas D, "Cloud Enterprise Resource Planning System," *International Journal of Computer Trends and Technology (IJCTT),* vol. 55, no. 1, pp. 50-81, 2018.

[22] Patrot A, "Internet of Things (IoT) Security Issues and Challenges," *International Journal of Computer Trends and Technology*, vol. 70, no. 6, pp. 72-75, 2022. *Crossref,* https://doi.org/[15].14445/22312803/IJCTT-V70I6P[15]8

[23] Vidas-Bubanja M, "Implementation of Green ICT for Sustainable Economic Development*," 37th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO),* pp. 1592-1597, 2014.

[24] Mahdavi S. and Sojoodi S, "Impact of ICT on Environment," 2021. *Crossref,* 10.21203/rs.3.rs-1020622/v1.

[25] Nanath K. and Radhakrishna P, "Green Information Technology: Literature Review and Research Domains," *Journal of Management Systems*, vol. 24, pp. 57-79, 2014.