

# Challenges of Technology in African Countries: A Case Study of Zambia

Emile S. Mbungu Kala<sup>1,2</sup>

<sup>1</sup>Department of Computer Science, Northrise University, Ndola, Zambia

<sup>2</sup>Department of Business, University of Zambia (UNZA), Lusaka, Zambia

Email: jackemile@gmx.com

**How to cite this paper:** Kala, E.S.M. (2023) Challenges of Technology in African Countries: A Case Study of Zambia. *Open Journal of Safety Science and Technology*, 13, 202-230.

<https://doi.org/10.4236/ojsst.2023.134011>

**Received:** October 2, 2023

**Accepted:** December 22, 2023

**Published:** December 25, 2023

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## Abstract

The challenges of technology in African countries, with a focus on Zambia, are numerous and complex. While technology has the potential to greatly benefit these nations, it also presents significant hurdles that must be overcome. One of the primary challenges is the lack of infrastructure. Many African countries, including Zambia, have limited access to electricity and internet connectivity. Without reliable power sources and a strong telecommunications network, it is difficult for these nations to fully embrace and utilize technology. This hampers economic development and limits opportunities for education and innovation. Another challenge is the high cost of technology. In many African countries, the average income is low, making it difficult for individuals and businesses to afford expensive technological devices and services. This creates a digital divide between those who can afford access to technology and those who cannot. As a result, many people are left behind in terms of accessing information, job opportunities, and social connections. Additionally, there is a lack of technical skills among the population. While there may be some individuals who are proficient in using technology, overall, there is a shortage of trained professionals who can develop and maintain technological systems. This limits the ability of African countries to fully harness the potential benefits of technology. Furthermore, there are cultural barriers that impede the adoption of new technologies. In some cases, traditional beliefs or practices may clash with modern technological advancements. For example, in rural areas where agriculture is prevalent, farmers may be resistant to using new farming techniques or equipment because they prefer traditional methods passed down through generations. Moreover, cybersecurity threats pose significant challenges for African countries as they strive to embrace technology. With limited resources dedicated to cybersecurity measures, these nations become vulnerable targets for cyberattacks that can disrupt critical infrastructure or compromise sensitive data. Despite these

challenges, it is important not to overlook the potential benefits that technology can bring to African countries like Zambia. Technology has already shown promise in improving healthcare delivery through telemedicine initiatives that connect remote communities with medical professionals. It has also facilitated access to financial services through mobile banking, empowering individuals who were previously excluded from the formal banking sector. In conclusion, the challenges of technology in African countries, with a focus on Zambia, are multifaceted and require comprehensive solutions. Addressing issues such as infrastructure development, affordability, skills training, cultural barriers, and cybersecurity will be crucial in unlocking the full potential of technology for these nations. By overcoming these challenges, African countries can harness technology to drive economic growth, improve education and healthcare outcomes, and enhance overall quality of life for their citizens.

### **Keywords**

Technology, Cybersecurity, Business, Africa, Zambia, Economy

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## **1. Introduction**

Today's technology is ultra-advanced, which we are experiencing in our day-to-day life either through personal experience or through the media around us. Satellites, drones, mobiles, artificial intelligence, virtual reality, internet, 3D printing, robotics and blockchain are all shaking up the world as we know it. Advancement in science and technology has made people to believe that technological advancement will lead to machines and robots replacing human beings, rendering large swaths of the population jobless, while some section sees enormous potential for least developed countries (LDCs) to leapfrog along their development trajectories. Although, technology poses many challenges for LDCs, who want to take advantage of the opportunities presented by the fourth industrial revolution (4IR), these countries will need to put in place certain measures to tackle issues around accessibility, affordability and the application of technologies.

According to Department of Economic and social affairs of United Nations Least Developed Countries (LDCs) are low-income countries confronting severe structural impediments to sustainable development [1]. There are currently 46 countries under LDCs categories including Zambia. These countries are highly vulnerable to economic and environmental shocks and have low levels of human assets as per the economic analysis of united nation. Although it's fact that LDCs are facing several challenges and hurdles in adopting and adapting technological progress new generation is witnessing. The United Nations offers exclusive access to certain international support measures, in the areas of development assistance and trade through its world charter. LDCs comprise approximately 14%

of the world's population, but these countries account for 1.3% of global gross domestic product (GDP) and meagerly 1 per cent of global trade [2].

Support measures have been developed for LDC categories in the context of international agreements and organizations as well as by individual countries, educational institutions and others, with a view to assisting these countries in overcoming their challenges. LDCs act as a group in many negotiations and intergovernmental deliberations on development issues particularly with respect to trade and climate change which promotes their common interests [3].

The Substantial New Program of Action for the 1980s for the Least Developed Countries, adopted in 1981 at the first United Nations Conference on the Least Developed Countries aimed at transforming economies and enable these countries to provide minimum standards of nutrition, health, housing and education as well as job opportunities to their citizens, mainly to the Urban and Rural poor. Further in 1990, in the Paris declaration and program of action of the Second United Nations conference, priority areas were set on human resources development, macroeconomic policy, rural development and food production, the development of a diversified productive sector and reversing the trend towards environmental degradation and reinforcing action to address disasters. In the Brussels Program of Action for the Least Developed Countries for the Decade 2001-2010 adopted at the Third United Nations Conference the priority areas decided by United Nations were set to developing human and institutional resources, removing supply-side constraints and enhancing productive capacity, accelerating growth and expanding the participation of LDCs in world trade and in global financial and investment flows. United Nations fixed priority areas for Least Developed Countries in the Istanbul Program of Action for the Least Developed Countries for the Decade 2011-2020, as Agriculture, productive capacity, food security and rural development, Commodities, trade, human and social development, mobilizing financial resources for development and capacity-building, multiple crises and other emerging challenges and good governance at all levels [4].

The United Nations efforts to cement the gap of development between developed and non-developed countries, and to pull out the countries suffering on economic, humanitarian, social and cultural platforms, through technological revolution. Zambia is a Least Developed Country as per the definitions provided by the General Assembly of the United Nations and by its Economic and Social Council (ECOSOC) [5]. It says Least Developed Countries (LDCs) can be identified by three criteria:

- 1) Low-income, a three-year average of Gross National Income (GNI) per capita (under US\$1018 for inclusion, above US\$1222 for graduation, above US\$2444 Income-only for graduation), Zambia with its landlocked geography covers total land area of 752,610 square kilometers [6] and population density 26.60 people per square kilometer (2022) [7] with population 19,610,769 as of 8<sup>th</sup> September 2022 [8]. Gross national income (GNI) per capita for Zambia in the year 2021

has been reported as US\$1411, which is slightly greater than LDCs US\$ 1274, but far behind the developing countries US\$6666.

2) A composite Human Assets Index (HAI) based on percentage of population undernourished, mortality rate for children aged five years or under, the secondary school enrolment ratio and adult literacy rate. On HAI index Zambia has scored 67.1 while threshold values were 62.0 or below for inclusion and 66.0 or above for graduation as per the data released by United Nations for the year 2021. The HAI for LDCs were 57.6 while for developing countries this figure was 78.1 [9]. On HAI index Zambia has shown remarkable improvements which can be considered as positive move. For steady and sustainable development and wellbeing of a country, HAI must be considerably strong enough to indicate the soundness of that country. Better placed countries on the HAI index are likely to perform better on all fronts, whether it is technological advancements, cultural and political progression or environmental and social welfare.

3) A composite Economic Vulnerability Index (EVI) based on population size, remoteness, merchandise export concentration, share of agriculture, forestry and fisheries in GDP, homelessness owing to natural disasters, instability of agricultural production, and instability of exports of goods and services. Directly or indirectly EVI is connected with technology. Only technological advancement, either through technological adaptation, adaptation, transfer or acquisition, will ensure better performance by a country on EVI index. Zambia's value at 41.7 has not matched even to LDCs score 39.1, while as per the criterion set by United Nations for inclusion is 36.0 or above and for graduation 32.0 or below [10]. Although developing countries are trying hard to overcome the economic and environmental vulnerability, but most of the countries has not even achieved threshold values. In the case of LDCs the condition is very grim. Progress in technology can only be achieved through stability, vision, strategy and soundness of a country and all these are reflected in overall assessment of all three variables (GNI, HAI and EVI).

In the time of globalization technological advancement is unambiguously correlated to it. Technologically the world has advanced with a rapid pace, developed countries are much ahead in this, they are thinking ahead of time, some ultra-advanced technologies are being developed and tested, in comparison least developed countries are still far behind, even hundreds of years in some areas. The Industrial age has brought about an increased volume and variety of manufactured goods and an improved standard of living by revolutionized manufacturing units (factories and mass production), powered machineries, transportation, communication and banking, but the new age, the information age has increased the rate of globalization like never before. Electronic revolution brought Digital age or Information age or Computer age as the rapid expansion of the Internet creates an irreversibly networked world. Rapid growth or spread of technology can lead to positive cultural growth; strengthen democracy, alleviation of poverty, capacity building and improved standard of living. Globalization

theory has increased cultural awareness, promoted diversity and virtually divulged the concept of global family. In this case one has to intact his identity else they have to lose it and assimilate into an increasingly westernized world or to those who have major share of technological pie [11].

Technological advancements are divided into three phases, Initial, Middle and Advanced, as per the stage of development a country can be placed in initial phase, middle phase and advanced phase. Most of the Developed countries are in advance phase even they have achieved ultra-advanced stage of development, while some developing countries are competing to become more advanced. Some developing countries have entered an advanced phase, while graduated LDCs have marched towards the middle phase of development. But LDCs are still in the initial phase of technological development. Zambia, comes under LDC category, struggling to adopt and adapt technologies to leap forward to middle phase of technological advancement, but still notoriously slow progression in adaptation of technologies has debarred it from graduating to exit from LDCs list. Adoption of technology can have profound effects on economies, such as reducing the national costs of production, establishing standards for quality, and allowing individuals to communicate from a distance. Unfortunately, this process remains one of adaptation, rather than innovation. There are many challenges in the diffusion of technology in least developed country like Zambia that persists is its uneven distribution and penetration within the country. As developed nations possess most of the technologies, must moderate their influence and carefully orchestrate any interference in third-world development. “Rapid changes in unstable environments and a lack of infrastructure will lead to destabilization and cause more problems than they solve” [12].

Despite impressive growth of technological advancement in least developed countries (LDCs), a large gap remains because the LDCs is only in the stages of adopting pre-existing technologies, rather than actively pursuing new innovations, *i.e.*, only exogenous technology is flourishing. Technology transfer or diffusion of new technologies between countries is very quick, but dissemination within a nation takes much time [13]. The unequal provision of opportunities to access and contribute to knowledge, networks and information to benefit from the development-enhancing capabilities of Information and Communication Technology (ICT) has been termed as the Digital Divide [14]. In the past ICT was not considered as a viable option for development. Policies where other needs, such as creating infrastructure (roads, bridge, railways, hospitals etc.), providing drinking water, health and sanitation facilities etc. were considered more urgent. The sudden surge in Information and communication technology drew attention and the digital divide has become one of the most prominent considerations in the Development divide.

Technological progression is highly associated with economic development of a country and liberalization of financial markets is considered to have contri-

buted to economic development. In LDCs, investment, even foreign direct investment (FDI), which is important to technological advancement in LDCs, is costly, in some cases unaffordable. To achieve investments and FDI, well-developed financial markets require depth, access, efficiency and stability. Here “Depth” means that financial institutions and financial markets are a sufficient size. “Access” reflects the degree to which economic agents use financial services and “Efficiency” means that financial institutions can successfully intermediate financial resources, and to facilitate transactions. Finally, “stability” refers to low market volatility plus low institutional fragility. Financial stability is very important in every situation of technology transfer, technology transmission, technology innovation, technology adoption, technology dissemination, technology diffusion and technology implementation. Unstable economy of LDC like Zambia is one of the major challenges in technology acceptance, acquisition, adaptation, adoption, implementation and innovation.

However, Technology is getting more and more attention throughout the world, but reality remains tilted towards developed nations or to certain parts of the world. Scientific inventions and innovation is almost exclusively a high-income activity, it requires extensive research and development, specialized infrastructure, highly skilled manpower, well planned vision and mission with précised objective and luxurious funding<sup>1</sup>. As **Figure 1** clearly shows the trends in technological innovation and inventions which are more or less concentrated in one end *i.e.* to high-income countries or developed countries or mainly western world. LDCs have almost no share in innovation and inventions as their main priorities remains survival or feeding their poor people. Zambia also facing the same situation LDCs facing. There are many hurdles in technology adaptation and adaptation. These countries are facing fundamental problems that are preventing them from accepting the move of technological advancement which



Source: World Bank.

**Figure 1.** Scientific invention and innovation categories wise (countries).

<sup>1</sup>Luxurious Funding—In the case of research and development projects there is no guarantee that project will be successful, it may fail and whole funding can go waste, and there are need of heavy and continuous funding with no limit and time constrain.

we will analyze in this article.

## 2. Research Purpose

The article “Challenges of Technology in African Countries: Case Study of Zambia” aims to explore the research purpose behind the difficulties faced by African countries, with a specific focus on Zambia, in adopting and implementing technology. This persuasive essay will discuss the significance of this research and why it is essential to address these challenges.

Firstly, understanding the challenges of technology adoption in African countries is crucial for their overall development. Technology plays a vital role in various aspects of society, including education, healthcare, agriculture, and governance. By identifying the obstacles faced by these countries, policymakers can design effective strategies to bridge the digital divide and promote sustainable development.

Secondly, focusing on Zambia as a case study provides valuable insights into the broader context of technology challenges in Africa. Zambia represents many other African nations grappling with similar issues such as limited access to infrastructure, high costs associated with technology implementation, lack of technical skills among citizens, and inadequate government support. By studying Zambia’s experiences and solutions attempted thus far, researchers can propose recommendations that are applicable across multiple African countries.

Furthermore, addressing these challenges is essential for economic growth and poverty reduction. The World Bank estimates that increasing internet penetration by 10% could lead to a 1.38% increase in GDP per capita for low- and middle-income countries. However, without overcoming technological barriers such as limited connectivity or outdated infrastructure systems prevalent in many African nations like Zambia, economic progress will remain stagnant.

Moreover, this research also sheds light on potential opportunities that arise from overcoming these challenges. For instance, innovative solutions tailored to local needs can be developed through collaboration between governments, private sector entities, NGOs (non-governmental organizations), and international partners. These partnerships can foster entrepreneurship and create employment opportunities within the technology sector while simultaneously addressing societal needs.

Lastly but not least importantly is bridging the digital divide between urban areas and rural communities within African countries like Zambia. Rural populations often face more significant barriers due to limited infrastructure and re-sources. By understanding the specific challenges faced by these communities, policymakers can develop targeted interventions to ensure equitable access to technology and its benefits.

In conclusion, the research purpose of the article “Challenges of Technology

in African Countries: Case Study of Zambia” is significant for several reasons. It provides insights into the obstacles faced by African countries in adopting and implementing technology, offers recommendations applicable across multiple nations, promotes economic growth and poverty reduction, identifies potential opportunities for innovation and collaboration, and addresses the digital divide between urban and rural areas. By addressing these challenges head-on, African countries can harness the power of technology to drive sustainable development and improve the lives of their citizens.

### 3. Literature Review

Technology is a star attraction for the whole world in the new age and the existing literature is replete with studies covering every aspect of technological move whether it be successes of technology or barriers of technology in adopting it. The world has advanced one step ahead of industrial revolution and memories of industrial revolution have been transcended by new media revolution or Information revolution. Currently we are living in an information age; hence we must think of it to catch the pace of faster growth. Developed countries are thinking ahead of time, developing countries are running fast to catch the train, but major concerns remain are least developed countries, those are notoriously lagging in the race. Everyday ICT is offering new innovations, new technological breakthroughs, new product lines, new opportunities for those countries that are in line of technological race. In the case of LDCs like Zambia there are needs to analyze every aspect of success and failure of technological adoption and adaptation in countries perspective. There is very little literature available that offers the same within a theoretical framework and seldom gives voice to the end user. Every country has a different situational context influenced by many visible and non-visible aspects. We must understand the situational context, as every nation has its own unique set of trials, tribulations, and strengths that may or may not impact innovation adoption. Innovation adoption theories applied to one country may not fit to another country, hence individual study and analysis is much needed to ensure appropriate technological success.

Rogers (2003) framed model of the diffusion of innovations, which defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (2003: p. 12). Further Rogers defined adoption as “a decision to make full use of an innovation as the best course of action available” (2003: p. 473). Rogers’s model tried to explain the process by which innovations are adopted by members of society. Rogers’s study describes five characteristics that impact a person’s choice to adopt an innovation: 1) Relative advantage—degree to which an innovation is perceived as a better idea, 2) Compatibility—degree of consistency with one’s values, experiences and needs, 3) Complexity—Perceived degree of difficulty with using the innovation, 4) Observability—degree to which one can see results of using the innovation, and 5) Trialability—degree to which the innovation can be experimented with or prac-



ticed. Rogers (2003) claimed that “if an innovation is perceived to be advantageous; is compatible with existing norms, beliefs, and past experiences; has a relatively low level of complexity; can be experimented with; and use of the innovation has observable results, including being able to see others using the innovation, then there will be an increased likelihood of adoption.” Adoption of technology can experience success and barriers on the nature of adopter, as Rogers tried to explain types of adopters along with innovation characteristics. A country can make success if its people adopt the technologies being transferred to it or technologies being introduced to its people. Rogers described five types of adopters based on the degree to which a person adopts an innovation as a) Adopter who adopts the innovation early; b) Adopter who adopts the innovation later; c) Adopters who reinvent or modify how they use the innovation; d) Adopters who discontinue use of the innovation after previously made use of the innovation; e) Adopter who reject use of the innovation.

To increase adoption of ICTs in least developed countries (LDCs), Tiene (2004) and Hawkins (2002) both observed that a focus must be placed on meeting the needs and addressing the limitations of the end user by demonstrating the advantages to adopting a given technological innovation. In less developed countries efforts to increase the adoption of information and communication technologies often fail to improve educational efforts (Tiene, 2004). He (Tiene) observed that “one critical mistake is to be overly ambitious and overly optimistic about what technology can accomplish” (2004: p. 90). Common challenges and barriers to technology adoption in least developed countries include a lack of ongoing support and a failure to include stakeholders and users in ICT planning (Tiene, 2004), which resulted in many projects fail to capitalize on developing advantageous ICT solutions relative to the needs of the end user [15].

Cheng and Townsend (2000) and Cheng (2001) have noted that the challenge for nations is to develop a comprehensive ICT package that includes “software, hardware and training as well as an ICT platform to support and maintain the effective and efficient use of ICT in teaching and learning” (2007: p. 260). The team found that nations are challenged to bridge the gap between ICT and curriculum development. Most of the nation experiencing challenges bridging technological change and cultural norms, failure to adjust to the paradigm shift has caused strong resistance from practitioners. The four challenges observed by Cheng and Townsend (2000) first, there is incongruence between educational aims and the use of ICTs, second, there is a gap among hardware, software and training, third, the nations are challenged to bridge the gap between ICT and curriculum development, and fourth nations experiencing challenges bridging technological change and cultural norms, address unique aspects of an innovation’s compatibility with the a community’s existing beliefs, norms and systems [16].

Pelgrum (2001) conducted a study to understand the obstacles that hinder

advancing ICT-related goals. In his worldwide survey of educational practitioners in primary and secondary schools in 26 countries at varying levels of development, he compiled a list of 38 obstacles faced by school principals and technology experts. Pelgrum found two obstacles dealing with complexity out of the top-10 to successfully implementing ICT in Education initiatives. His observation shows that a lack of knowledge and skills about ICTs multiplies with difficulty integrating them in instruction. Further, it has been observed in study that a main challenge of ICT adoption in LDCs is the inability for the end user to troubleshoot hardware and software that lack of troubleshooting ability increases the complexity of using the innovation [17].

Technology should be appropriate and sustainable to get adopted and accepted by people, the same has been witnessed in some development projects, where focus on implementing more sustainable and technologically appropriate solutions has been prioritized. For example, projects such as the EQUIP2/Zambia funded by USAID (2008) are using energy-efficient thin clients with liquid crystal display (LCD) monitors rather than older computers with bulky cathode ray tube (CRT) monitors that require large amounts of electricity. In the present context new technology is more relevant and appropriate as old technology gets obsolete and there is no market for it or in some cases companies have stopped production of old technologies completely. In case of EQUIP2/Zambia project USAID has equipped the end user with future technology instead of equipping with old obsolete technology which may have created broken continuity in development [18].

One of the most popular models in the adoption of technology in society *i.e.*, Technology Acceptance Model (TAM), is basically an information systems theory that ideally models how users come to accept and use a technology. Technology Acceptance Model proposes that when presented with a new technology, the user's decision about how and when they will use it is influenced by several factors, notably: Perceived usefulness (PU). This (PU) was defined by Davis (1989) as "the degree to which a person believes that using a particular system would enhance his or her job performance".

Cooper (2002) in his essay examined the increasing ubiquity of the Internet and related technologies (ICT) in an abstract, philosophical sense. Article highlighted the impact of the Internet on the world and human culture at large, where Cooper investigated three major philosophical stances on the role and future of the Internet dystopian, utopianism and pure utilitarianism as well as the idea of a technopole<sup>2</sup>, in which culture surrenders completely to technology [19].

Markel Foundation published a detailed report with several primary contributors, revealed numerous successful accounts of ICT being used to make improvements in Education, Health, Economic opportunity and the Environment in countries such as Brazil, Costa Rica, Estonia, India, Malaysia, South Africa, and Tanzania. This article describes how specific ICT achievements projects can

<sup>2</sup>Technopole—The cultural state of mind that assumes technology is always positive and of value.

help low-income countries or LDCs achieve the goals of the Millennium Declaration set by the General Assembly of the United Nations in September 2000 [20].

Davis and Ochieng (2006), suggest that African nations should not attempt to emulate the formal economic structure that has been successful in many developed countries. They find that African entrepreneurs are adapting ICTs into products and services more suited to the needs of the population. The paper examined several compelling case studies from around the continent to demonstrate how mobile technology and as a result, greater access to market information, are contributing to and defining Africa's "modern" economy [21].

Spolaore (2006) presented a paper which discussed the barriers to the spread of technology in the information age. In his study researchers argue that technological diffusion is largely constrained by genealogical differences, and that cultural differences affect innovation just as much as innovation effects cultural change [22].

Addressing the issue of brain drain an article in China Daily suggests, "in addition to educating their citizens, developing nations must find ways to entice their citizens, once educated, to remain in their homeland as opposed to emigrating to more developed nations where they can apply their skills and training to earn higher wages and enjoy higher standards of living." This article of China Daily presented the manner in which China actively encourages its best and brightest to leave the country in pursuit of a western education so that they may then return home to China. This theory has best suited to China in gaining technology and skills that they may have not gained by indigenous attempt.

Global Economic Prospects 2008, publication provides an overview of the recent and current state of technology and technological diffusion throughout the world. Report emphasizes the need for strong diffusion of technology within countries to facilitate increased economic advancement. Publication emphasizes that industrialized nations dominate the global technological frontier and that increased technology use in developing countries is mainly limited to the adoption of preexisting technologies, rather than the invention of novel ones [23].

Gunawardana uses Shri Lanka as a case study to assess the state of technological diffusion, with special regard to the Internet, in developing countries which examined the effects of information technology on politics, business, education, and culture. The study of Sri Lanka fits to most of the developing countries and LDCs due to its ongoing transformation from a rural to an urban economy, as well as its importance to and reliance on developed nations [24].

There is much more literature available but most literature covers some specific subjects and issues related to technology with targeted intervention. Since Zambia is a country with specific geography, culture and traits, its overall technological needs and challenges may be influenced by several factors. But there were hardly any articles or literature I came across which cover comprehensive subject areas to address technology challenges a least developed countries are

facing. With extensive literature review, analysis and investigation we will try to formulate a comprehensive outline of technology challenges and appropriate solution in context of Zambia in next section.

#### 4. What Technology Can Do for LDCs?

Technology is very important for LDCs in the globalized world economy, which can benefit evolving economy of least developed countries like Zambia, Congo DR, Angola etc. in term of:

Prosperity boom—the most important drive of the booming prosperity, creation, distribution and application of knowledge, which are the basis of the knowledge economy, have been witnessed in the countries those are following prescription to adopt the technology with efficiency. Zambian national must adopt technology to be take advantage of prosperity boom that has sheltered most of the developing countries.

Operational efficiency—means technology will help government services to be more efficient and less cumbersome and will help to free government operations in the least developed countries from the legendary corruption and bureaucratic frustrations. It will help better implementation of planned projects and programs designed in view of future scopes. If Zambia must be in line of development and catch the train of globalization and welfare of its people, it has to follow the operational efficiency path with technological advancements and modernization world economy is witnessing.

Opportunity to leapfrog—As developed countries have surged to height of technological advancement, developing countries and LDCs have opportunity to leapfrog the learning curve that will pull them up in developing bracket. Developing countries along with various international organization are trying hard to prescribe LDCs to follow technological adaptations, that is going to advantage both developed as well as developing countries in some way or others, example being developed countries will get market for their products and services, while developing countries will get opportunities to get technology to avail opportunities and make prosperous.

Technology is feasible—use of technology is feasible for LDCs, it might not even cope with the basic challenges of poverty, illiteracy, and poor infrastructure, but a transition is possible, as many hitherto poor nations have done. Zambia can also take advantage of feasible nature of technology which solves many problems and makes transition phase smoother and more realistic in view of globalization and future visions.

Technology can be boon for least developed countries like Zambia if collective efforts by both Government and people of Zambia, initiate in right direction, with right motive, right selection and positive motivation with a mission of nation upliftment with a vision to grab global opportunity. Although, technology will only gain ground if knowledge becomes paramount in its application. Today, we are talking about “virtual Company” in the age of internet or advanced

information technology world, where there exists a company, but it has no physical existence anywhere. Advanced nations, developing countries are grabbing the opportunity of advancement of information technology, so can least developed countries with minimal efforts, investment and risk to introduce them in global market.

Zambia must come forward with well-planned format for its people to introduce to technology, which is future. In an article published by the U.S. department of Commerce in 1998<sup>3</sup>, “The Emerging Digital Economy”, reported that information technology alone was responsible for 35% of overall economic growth in the United State from 1995-1997, that was over one trillion dollars in additional national output in that period, which can probably surpass the whole GDP of Zambia. Such is the impact of technology, if adopted in time with the right motivation [25].

In fact, if technology is used in optimal way, it can stimulate new business methods, new means of work organization, quality improvement and large opportunity to youths in country like Zambia and trigger overall growth of economy of Zambia. Least Developed countries should take a leaf from the success stories of advanced nations to formulate their development path to apply innovations that will boost development of high value products, services, and production processes. Zambia need to address, in practical terms, everything from education and skill training initiatives to increase the available “talent pool” to greater investment terms in “frontier” research. LDCs should ensure that their any segment of people should not be left behind, else it will be more gap than advancement claimed.

## 5. Interoperability Problems in the Developing Countries

The impact of technology could be overwhelmingly positive as it provides information, the ability to communicate with others around the world, support the people of country, increase prosperity index, cope with hunger and famines as LDCs have it in major terms, opportunities to youths as unemployment is surging with increased population and less opportunities available, and one-unimaginable opportunities to do business globally. In recent G-20 meet ended in India has boasted the theme of one Global family, means world is marching towards one global family concept or globalization very fast, in such condition LDCs should come forward with their offers what they must join the global economic boom. Many developed countries and developing countries are applying technology to serve their people in terms of education, medical, public safety, agriculture, mass production, industrial development, telecommunication, information technology and other types of critical services in close cooper-

<sup>3</sup>See U.S. dep’t of commerce, the emerging digital economy A1-5 (1998). The report is available on the Department of Commerce’s “Electronic Commerce Policy” Web site (visited Aug. 3, 1999) <<http://www.ecommerce.gov/emerging.htm>>. A second report on this topic was issued by the Commerce Department in June 1999. See generally U.S. dep’t of commerce, the emerging digital economy II (1999).

ation with advanced or countries those have developed the technology. Technology could be acquired mainly in two ways: either we have to develop it or collaborate/borrow/partner/acquire from developers. The first option is very expensive, time consuming and needs patience, investment, talent pool, long term planning and of course stability. The second option is somehow easy and need mutual understanding and suitable policies that suit to the technology developers and technological interoperability, as it remains one of the major hurdles in acquiring the technology by LDCs.

There is a general digital divide of which one part is the standardization gap between the developing and developed countries which is recognized in resolution 44 (Johannesburg, 2008 International Telecommunication Union (ITU)). This resolution has three dimensions: the disparity of voluntary standardization, the disparity of mandatory technical regulations and the disparity of conformity assessment. Further resolution 76 (Johannesburg, 2008 ITU) on conformance and interoperability testing considered that some countries, especially the LDCs (ITU has included LDCs (Least Developed Countries) in developing countries categories list along with SIDS (Small Island Developing States) and EIT (Countries with Economies in Transition), have not yet acquired the capacity to test equipment and provide assurance to consumers in their countries, and increased confidence in the conformance of information and communication technology (ICT) equipment with ITU-T Recommendations would increase the chances of end-to-end interoperability of equipment from different manufacturers, and would assist developing countries in the choice of solutions [26].

ITU noted that the need to assist developing countries in facilitating solutions which will exhibit interoperability and reduce the cost of systems and equipment procurement by operators, particularly in the developing countries, whilst improving product quality. To resolve this, ITU suggested to assist developing countries in identifying human and institutional capacity building and training opportunities in conformity and interoperability testing and assist developing countries in establishing regional or sub-regional conformity and interoperability centers suitable to perform conformity and interoperability testing as appropriate. Enormous progress has been made in bridging the digital divide and standardization gap; there remain significant problems in terms of conformance and interoperability, the reason being Lack of human capacity and of training opportunities, and weak institutional systems for standardization, testing, certification and market surveillance. These problems are not uniform in nature, hence careful assessment of regional and national circumstances and experiences are required. In case of Zambia, we must investigate matter carefully on the ground of nation's circumstances, experiences, culture and national capabilities along with national stability.

ITC noted in draft information document on resolution 76, "much of the ICT equipment in developing countries is old, but has yet to be withdrawn from use, because of limited capital to purchase replacements. The interfaces and proto-

cols of such systems are not able to communicate with any modern systems that are more complex and sophisticated. It required the use of gateways which reduces functionality and increases costs. For example, one international operator wishing to provide lower cost international connectivity into a NE African country had to provide a special gateway to what it considered obsolete technology.” Zambia is facing same problems as most of the least developed countries in African continent. Unlike in the developed countries, Zambia do not have laboratories to test whether communications equipment and systems conforms to the required international, regional and national standards, as in most of the African countries, making interoperability testing a challenge.

Technologies that match international standards are costly and mostly unaffordable to LDCs. And developed countries, custodians of most of the technologies are more concern to their profit oriented and dominating mindset, they are only willing to sell their services and products in market rather transfer the technology or impart the technological knowledge to remote countries. There is another problem with LDCs, if some countries are willing to transfer the breakthrough technology, there are big problem of infrastructure and skilled manpower. If again if some countries are willing to invest in infrastructure and skilling the person, there are problems of national stability, acceptance, cultural gap, educational levels and of course government policies of that nation.

Draft information documents further stressed that few countries in Africa have in place the necessary accreditation systems and technical regulations needed to provide a framework for the granting of certificates and telecommunications equipment. It says, “There is a general lack of expertise and human capacity in standardization. African countries have been less able than developed countries to participate in and to influence standards making processes. One consequence of this is that they have been much less involved in the work of devising conformity and interoperability tests and then of conducting the tests of equipment and services.”

Training is one of the main parts in use and spread of technology, but in African countries or LDCs, particularly in Zambia, training in standardization and testing has been insufficient and when available been expensive or involved travel. Training facilities are not commonly available, it may be due to insufficient infrastructure, lack of policy matters, social and cultural acceptance and insufficient qualifying skills, this has resulted in a lack of understanding of test results when they are submitted from accredited laboratories. There is a lack of understanding of international standards concerning the implementation of interoperability of ICT devices and systems.

Since LDCs are not innovator of technology, when different counties with same technology enter into the market in these countries, there arises some confusion due to large and growing number of producers of standards, especially since the standards and the resulting interfaces and equipment are mostly not interoperable. There is a big problem of compatibility, which sometimes results

in breakdown of system or malfunction of system or system crash or dead system. In ICT, radio frequencies are also a big problem, as most of the African countries are dependent on western countries or developed countries for this system, some of the system get dead due to unavailability of specific spectrum.

In nutshell, Zambia is facing following problems in case of ICT:

- Increased supply of poor-quality equipment.
- Difficulties in the selection of interoperable equipment from a wide range of vendors.
- Lack of testing centers, facilities and trained professionals.
- Lack of national or regional laws and regulations; and
- Lack of understanding of ITU-T Recommendations, the conformance tests and their results.

Interoperability is not only confined to ICT, but applicable to all other technological fields in same way, whether it be medical technology, biotechnology, space technology, industrial technology, mechanical technology, artificial intelligence, entertainment technology, operational technology, assistive technology, hospitality technology, super-intelligence, Business technology, agriculture technology, robotic technology, architecture technology, food and product technology, construction technology, blockchain technology, aerospace technology, military technology etc. These problems persist with every developing country or least developed countries like Zambia, where almost all the technologies are borrowed from developed countries.

Most of the developing countries are not innovators of technology. These countries are only markets for technology innovators or developed countries, and all innovator countries have their own specification for their products and services that does not match to others in design and working specification. Although in the age of globalization, various efforts have been made to chalk out a common standard for the product so that they be compatible to each other, but this effort is not visible on ground and problem of interoperability still exist in LDCs as they are using old technology in which integration of new technology is very difficult.

## **6. Why Are Developed Countries Becoming Markets for Technology?**

Geoff Colvin (2014) identified three major technological turning points; first arrival of “factory” and industrial technology, which triggered mass production and use of power in 19<sup>th</sup> century, second turning point, when electricity became widely available, which resulted in sophistication of industrialization, and third turning point, arrival of information and communication technology. When we closely monitor the situation and all industrial turning points or fourth industrial revolution 4IR, we can easily conclude that developing countries were only market for these revolutions where developed countries, or innovator of technology used these countries as market for their technological products. The



same trend is continued today also, as most of the developing countries or LDCs are only markets for technology, where technology only gets transferred in terms of products and services, and not in the form of row technological initiatives. Although, for immediate effect technological adoption can be seen as welfare and advancement but it can be a threat in the long term if these (LDCs) do not take technological advancement seriously and grow to develop technology for their own people [27].

This may take long time, but it will need, vision, commitment, planning, strategy and stability, which people of Zambia can learn from other developing countries those who has come close to compete with developed countries. There are great challenges for developing countries of least developed countries as a result of technological development especially in new technology, as it impacts on indigenous culture. As human nature, people get attracted to cultural traits of advanced nations or cultural supremacy presented by advanced countries, since information becomes globally accessible. The World Bank in its report, “Knowledge for Africa”<sup>4</sup> has stressed that the danger that the rapid growth in global knowledge and the explosion in technology will leave least developed countries even farther behind advanced countries. Despite the fall of communication costs, making the transfer of knowledge cheaper, developing and least developed countries have to cope with an ever-changing knowledge frontier that threatens to create wider gap.

## **7. What LDCs Will Miss without Technological Advancement?**

Whatever impact technology may have, but its compulsion for any country, civilization or society to stand in the line of survival. Increasing population world over poses a serious problem of survival with prosperity in limited resources. Zambia is also facing similar problems other LDCs or developing countries are facing, and for these problems there is only one solution available *i.e.*, adoption of technology irrespective of its means and methods of acquisition. Technology has progressed in every field, whether it be agriculture, industry, communication or information covering every aspect of life *i.e.*, health, education, medicine, food, clothing, survival, shelter or luxury.

Information technology has advanced much as we confirm from today’s popular apps, such as Facebook, Twitter, WhatsApp, Instagram, Telegram, YouTube, etc., which costs particularly nothing today to process information in one country and transmit it to people in other countries or even other continents. Adoption of technology have been witnessed all over the world, as free flow of information across the nations is blurring the national boundaries and integrat-

<sup>4</sup>See World development report 1998/99 Background Papers: Knowledge for Africa (visited June 30, 1999)

<<https://documents1.worldbank.org/curated/en/729771468328524815/pdf/184450WDR00PUBLIC00ENGLISH01998099.pdf>> [hereinafter Knowledge for Africa].

ing the nations of the world economically and even socially, exactly matching the theme of G-20 summit ended recently in India [28].

Technology is offering enormous opportunity to work together as for example a Multinational country in Zambia and their counterpart in other countries like United State or India can work together as if they are present in adjacent rooms of the same buildings. The power of globalization, if not matched with its growing pace, will eat into developing or least developed countries, without them even being aware of what is happening. LDCs will lag and will become only a matter of use for the advanced or developed countries as of now technologically advanced countries are using least developed countries for their resources and manpower to materialize their technological goals. In recent turmoil in global from this has been witnessed that people and resources from least developed countries or developing countries has been used for the benefits of advanced countries like United States, France, Russia and other European countries. If LDCs and in our case Zambia will not match its foot with globalization it has to face more stiff challenges in future as some of them has been discussed here.

1) Migration—In case we fail to acquire, adopt and adapt technology, we have to face large scale migration in two terms, first population migration, and second offshore migration of local jobs. First will drain out country of talent pool, and second strive the countries of local opportunities fueling unrest, unemployment, economic loss and resource exploitation. For example, multinational countries with operations in a developing or least developed countries now has the technology to domicile some of the tasks associated with its operations in the developing or least developed countries, like the administrative and logistics aspects of the operations, in another country. This means a company operating in Zambia will now easily choose to domicile all the administrative and logistics work of its Zambian operations in another country or continent that may be more conducive in terms of govt. stability (corruption, availability of well-trained workforce, bureaucratic bottlenecks, local resistance, social harmony etc.). In this case only skeletal staffs from Zambia will be used and opportunities a Zambian should avail will go to another nation, only because of technological negligence of Zambia and Zambian people. If you do not adopt and adapt the technology then it will enrich other countries and your resources will be exploited to grow the economy of another countries, other countries will avail opportunities at the cost of your negligence.

2) Global Encroachment—If LDCs fail to strive to have a competitive workforce, countries will be preyed to merciless global poaching. For example, when somebody makes an online purchase in the Zambia, somebody else in Asia, Europe, America or India has made a quite non-physical export to the Zambia. In several cases the sellers online are not owners of the products, but they are selling the product virtually through internet or global platform as somebody in India is selling products to Americans or Europeans. Even tiny ringtones generate great revenues to selling countries as thousands of non-physical exports is taking

place in developing countries or least developed countries during a given period without any recorded import data in that country. This global encroachment will not only snatch the opportunities and prosperities but also make more sidelined if LDCs ignore the technology.

3) Globalization of Job Opportunity—When a country ignores technological advancement it will face tough global competition for local jobs also. As it has been witnessed that, local professionals seeking jobs from MNCs needed to slug it out amongst themselves for whatever openings were available. But now an MNC can carry out its local jobs from other countries, through outsourcing, the local professionals in the developing countries or least developed countries will now not only have to square up among themselves, but increasingly stack well against the professionals in those other countries who have better infrastructure, facilities and advance training formats. Local professionals have to face and compete with quality opponents those are better equipped with technology and skills, even for what should have been their local jobs in their own country. Ignorance of technology by the host country will make MNC decide for domicile its support operations in the other nations.

It should be noted that negligence or resistance to acquire, adopt and adapt the technology will harm the least developed countries like Zambia. Hence its wide move to adopt the technology without viable resistance and with right motivation with long term planning with the involvement of govt. and people of Zambia alike.

## 8. What Zambia Can Do to Match Globalization?

Technology can be acquired mainly in two ways, indigenously and exogenously. For indigenously acquisition of technology requires strong research and development, infrastructure, visionary leadership and stable economic and political setups. For exogenous technology, strong economy, suitable infrastructure, pre-defined goals, abilities to absorb or adopt transferred technology should be in place. In cases where a country has to develop a suitable environment for technological adaptation and adaptation, else there would be no use of technology at all.

In ancient India, Sanskrit Subhashitani Sloka says:

यथा हि एकेन चक्रेण न रथस्य गतिर्भवेत् |  
एवं पुरुषकारेण विना दैवं न सिध्यति ||

“Just like a chariot cannot run with only a single wheel, in the same way luck will not favour the human without his/her efforts.” [29].

Means people of Zambia must come forward with strong will to make themselves prosperous, strong and lead their country. Govt. must work on long term planning with stability and people centric approach. Again, the approach should be focused and gal oriented as again a Sanskrit Sloka from Subhasitani says:

योजनानां सहस्रं तु शनैर्गच्छेत् पिपीलिका |  
आगच्छन् वैनतेयोपि पदमेकं न गच्छति ||

“Even a tiny creature such as an ant can move ahead miles together if it keeps on walking consistently. But if an Eagle doesn’t decide to leave its place then it can’t move even an inch ahead!!” Means, only having the capability will not do. One should also have the “Will” to achieve the goal. And thus, with a strong will an ant (With inferior capabilities) can keep on moving ahead, but the eagle (With much more superior capabilities)—without any efforts can’t even dream to reach near its goal! [30].

### **8.1. Zambia Should Do or Focused On**

Education—Education should be the primary focus of a country, and there should not be dirty politics about the rights to education. Education should be away from disparity, discrimination and barriers. Education is a human right and a vitalelement in combating exploitation, poverty and hunger. Education will bring change in society; promote democracy, advocacy for human rights, economic growth and prosperity to nation and people. Lack of education always goes with poor neighborhoods, poor job prospects, menial jobs, low salaries and crime. Education should be right at right place, periods and prospects, only then it will impact on right way.

Now question arise how a nation like Zambia can boost education? There are two ways to acquire education, first you develop your own infrastructure, and second you use infrastructure of advanced nations. In first case it will require more efforts and long-term planning for getting higher education but in second case we have to create brain pool at primary and higher secondary level to sail out our talent to gain advance knowledge and information or education from advanced nations or better positioned nation. But Zambia has to develop strong feelings among people for their culture, civilization, land and values so that their brain pool should return to their own country to shape the future as the China has done, which we have discussed earlier in this article.

Policy regulation—policy regulation is also vital point where country should have its focus. For any technology to enter a nation it has to leverage their policies that must match to the requirements and mutual demands of both host nation and providers else there will not be initiative to the new technology in any country. For example, telecoms companies paid a whopping \$285 million to the Nigerian government (as license fee), for the right to come into the country and give citizens the telecoms services that they needed desperately, for this Nigerian govt. mustderegulate its telecoms sector, without which they would have not been able to materialize the deal and a great economic loss to country may have happened. Hence Zambia, also must follow deregulation to welcome new technologies in future, that may be mutual understanding with technology providers.

Diaspora Linkages—Zambia has to initiate a strong linkage with international diaspora of their own citizens in advanced countries or countries better positioned than Zambia and also to the other diasporas those are open to all. Thousands of Zambian nationals or Africans have travelled to the advanced countries

or developing countries for their education, as refugees, or as a part of the famed brain drain. Nation should initiate investment promotion through agencies to facilitate liaison programs with these people, especially with those that have risen to influential corporate positions in their foreign land. Proper linkage with right diasporas can help in channelizing investment projects to their home nation, education and other skill initiative in their own land, agricultural and industrial initiative in their own land, if lucrative and beneficial offer will be made to come and invest. Zambians or Africans in advanced or developed countries can help in packaging their home nation to become more attractive to investors as they can better explain the situation, condition, prospects and can give assurance and feel of affinity.

Local linkages—Advanced countries have packages for LDCs or developing countries and also wants to expand its operation in Developing countries or least developed countries for profit and better global position. In this situation a better local linkage is required to grab the opportunities offered by the technologically advanced nations. Zambia needs to strengthen its local linkages to great extend with stability and less fear to seeking counties. Good local linkages will also overcome social and cultural resistance and will help in mingle global communities.

Clusters development—Zambia should take initiative to create or develop a pilot technology zone or technology clusters or technology parks similar to free-trade zone or to create industrial hub, that may attract investors from all the corners not from their own country but from other nations interested in investing in Zambia. This cluster development should have flexible norms and zero tolerance policy to make investors feel safe and secure in their business. Zambia should provide relatively higher level of infrastructure or resources at attractive offers to develop infrastructure from foreign investors. Every investor wants privilege and special treatment and feeling; hence nation should have this in mind and plan. Clusters must be near educational hubs, this will be mutual benefits to both industries and educational hubs (universities, research institutions, engineering colleges, medical colleges etc.).

## **8.2. Three Layered Strategies, Prepare, Introduce and Develop**

Technological progress is important for economic progress of Zambia. We can experience through wide study of economic development throughout the world, as most economically developed countries are also the most technologically advanced. That is Zambia has not only to make a proper and innovative utilization of technology, but also develop it on its own. For this Zambia must follow three layered strategies, Prepare, Introduce and Develop, which should be reflect in administrative vision of government with long term planning and commitment. Zambia must take a leaf from countries like China, South Korea and India, those who have economically surpassed many western countries, because they can catch up and surpass the technological capability of the western countries or de-

veloped countries.

Developed countries has vision to expand their technological base as wide as possible, hence developed countries take initiatives to advise developing countries to follow their irrefutable proof of their developmental prescriptions to catch up with technological advancement. Developing countries are encouraged and put pressure by the developed world and the international development policy established to adopt free market economy, through implementing a set of “good policies” and establishing “good institutions” to foster their economic development (Chang, 2002) [31].

Developing countries are encouraged to invite foreign direct investment (FDI) to establish manufacturing industries, establish science and technology (S&T) institutions and establish engineering and higher educational institutions. Developing countries have not only to imitate technology but must develop power and stability of state control and the agility of business enterprises. Countries those who have achieved the landmark have used the ontological and epistemological aspects of technology, which Zambia must analyze in bigger prospective.

According to the United Nations e-government Survey for 2014, Developing Countries were far behind the developed economies, in terms of learning the modern technology. It is obvious that the pace of learning modern or new technologies in developing countries or in least developed countries, is very concerning, which is a major hindrance in adopting the technology in LDCs.

Interdependent technologies—developed countries or countries that have developed technologies, never wish to transfer independent technology or complete transfer of technologies, which pose serious problems for the user. Every time user countries have to heavily dependent on the source country for its periodical up gradation, updates and spares, if upgradation is not done or upgradation is due, systems might stop working or malfunction. In some cases, companies or source countries stop production of old versions and stop making spare parts also, in this situation the machines or technologies get obsolete and must be upgraded or in case of breakdown, spare parts have to be manufactured or make locally which is very difficult and again require technological skills. But these efforts will only provide temporary relief or solution and will not be permanent. The pace of technological improvements or technological innovation or technological enhancement is so fast that even days are not enough to sustain one model. The companies try to make changes in models so that one model is quite different from other models so that one must be dependent on companies. The capitalistic thoughts highly oriented towards earning profit and continuous profitable market for companies makes technology interdependent and its nature to be independent remains questionable throughout in case of transferred or adopted technology. Better example of interdependent technology is JF-17 thunder aircraft, produced jointly by China and Pakistan. Recently one news has flashed that China has stopped supplying spare parts for JF-17 aircraft, due to which whole batch of JF-17 aircraft get grounded and are of no use. Countries those who have purchased JF-17 from Pakistan are not getting spare parts for

their aircrafts and whole fleets are grounded.

### **8.3. How Zambia Can Tackle Issues around Accessibility, Affordability and the Application of Technology**

Strengthen and enhance accessibility to technology and infrastructure—Like most of the LDCs, Zambia also facing challenges in acquiring relevant technologies, as almost all the technologies and innovations are protected by patents, which are highly concentrated in a handful of countries. If LDCs really want to catch the train of globalization, it has to overcome these problems through suitable policy changes, political stability and cultural, social and economic acceptance. These countries must invite FDIs (Foreign Direct investments), international collaboration and open access to domestic or local markets to international brands or technologies.

Zambia must invest in infrastructure and power sectors so that basics of technologies could be meeting and FDIs, international collaborations and open markets could be attracted. It's obvious when international brands or companies will come to country they will develop infrastructure, provide job opportunities, open and impart technological trainings to the people of Zambia, but this will happen only if Zambia succeed in developing basic infrastructures and power sectors. Zambia can use open-source technologies such as blockchain, which has changed the course of Ethiopia, so Zambia also must learn from Ethiopia. When we talk about infrastructure, Zambia must focus on its agricultural infrastructure and technologies access, as major hurdle in development remains food security for most of LDCs including Zambia. Agriculture sector could be prominent sector where Zambia can put its focus, because it requires comparatively less investment and technological input with high success rate. Calling FDIs and international collaboration will also be very easy as most of the brands and companies require raw materials in the form of agricultural product, which could be attraction to developed countries or innovators to invest in Zambian economy. Country must decide its strength before deciding on technological access and infrastructure development, as it has been seen in many countries, wrong decision has leads to failure and collapses.

Skill development and quality education—In most LDCs, emphasis is put on literacy. Increase in literacy will not ensure technological advancement in any form. Literacy could be basic awareness towards education, but for technological success, quality education is a must. For innovation, optimized use of technology skills is very much needed. Zambia must shift its focus on investing in science, technology, engineering and mathematics areas while putting special focus on soft skills such as creativity, collaboration and time management, which will provide stability in education and innovation and also develop skilled man-force to adopt modern technology. Although it's very true that country like Zambia is not rich in such resources, international collaboration, FDIs and external assistance can be invited in education skill development. People and govt. must pay

special attention towards flexibility and adaptability, which are keys to developing skills fit for the future. Zambia must learn from Rwanda, where Digital Opportunity Trust has launched a massive digital skill development program in cooperation with the World Economic Forum “to employ 5000 young Rwandans to provide hands-on basic digital literacy training to 5 million citizens. Not only will this help rural Rwandans who have low or no experience using the internet, but it will also help digitally literate citizens to use e-gov and e-business services.”

Affordable technology for all—In some cases technologies is accessible but it may not be affordable, which may prohibit people to use it that will nullify the planned effect of technology by any agencies or policy makers. Hence affordability of technology is one of the concern countries like Zambia should consider which must be aimed at breaking monopolies and oligopolies of technology providers. Technology should not be a showpiece to only demonstrate and show off, but it should achieve the desired goal for which it has been applied.

Scanning niche opportunities—LDCs should scan available opportunities for their people in race of globalization which should be based on internal assessment of country’s capacity, capabilities, skills, resources, access of technology, interest of international and domestic brands, strength of nation and compatible to national policies and interest. If a country’s strength is agriculture, it should put more focus on agriculture first and invite more technological advancements, investments, opportunities, initiatives and innovation to strengthen this sector, which will guarantee success and pave way to other sectors. Technology is a skill-oriented initiative which requires high skills for its success in field transfer, hence choosing, identifying and applying technology for any country’s progress should be scanned carefully.

Government’s initiatives—the 4IR requires good policy and regulation, which totally depends upon govt.’s initiatives. Zambian government has to introduce enabling and mitigating policies and regulations which fits to technological adaptation in country. All policy matters rest with the government and it is possible through coordinated action from various ministries, departments and institutions. Bad policies and decisions will not only derail the progress of a country but also debar from acquiring technologies from international bodies or countries those who are real custodians of the innovation or technologies. Zambian govt. should have a vision like, one a technology comes to country and get established, adopted and sufficient skills get generated, this will be easy to move one step forward in trying and do something in innovation with acquired knowledge and skills.

Partnership initiatives—Zambia, mostly dependent on its limited resources, as most of the LDCs lack resources, skills and expertise in many of the areas, there is an urgent need to harness partnership with potential partners at the national and international levels. But it should be careful in harnessing partnership, which should be scope oriented, interest in nation and its people and have long term effect and empower people of country not only selling and introducing its



product and services and concealing technologies and methodologies. In such cases a country will be only a market for international brands and technology innovators, which is not going to benefit the country in long term gain.

#### **8.4. Zambia Must Address Entrepreneur's Challenges for Technological Advancement**

After discussion and situational analysis, some suggestions can be put forwards that should get immediate attention. These are as follows:

1) Infrastructure—Zambia must develop and strengthen its basic infrastructure; without it is not possible to support technological advancement in the country.

2) Educational standards—Country must review its educational policies and bring some changes to match with international standards so that the skill force can absorb the technologies of advanced nations.

3) Financial Institutions—Every business has its primary goal to earn profit, i.e. linked to finance, hence financial institutions must be in sound condition, it should have minimal documentary requirements, hassle free operation and accessible.

4) Govt. policies—as we have discussed, govt. should have policies that can be mutually beneficial to technology providers and their people also.

5) Increased Technology accessibility—In some cases basic technologies are needed to support advanced technology or developmental work, in this case country has to provide these technologies to investors or users for better operability.

6) Quality checks—Zambia must switch to the quality product, as it will increase credibility and will stop country from being dumping yard of cheap and inferior products.

7) Informal Inputs—for technology to thrive it is important to have informal inputs.

8) Fast decision taking—in the age of technology nobody has patience, everything is fast and fast in such case slower decision will harm the country.

9) Encourage start-ups and collaboration—Zambia govt. and its people must take initiative to collaboration with foreign partners or get ready for startups, either on their own or with the help of foreigners.

10) Security assurance—this is important as everybody wants a safe and secure environment. Cultural dive and resistance will only push back technological advancement and will fail in case of choice of being destination.

Despite everything present in the country, technology is not leaping forward to run on the path of growth. Zambia has natural resources, good workforce, and will of people but, the need is to take initiative at next level so that our resources and global relation be reached to next level, which will result into new initiative in technological advancement in country. Hope country will stand up and take initiative to match the globalization.

## 9. Conclusions

Zambia, a landlocked country in Southern Africa, has been striving to embrace technology to foster development and overcome socio-economic challenges. However, one of the major obstacles it faces is an inadequate infrastructure that impedes its progress towards adopting modern technologies effectively. Insufficient access to electricity, limited internet connectivity, and inadequate transportation networks are among the key elements contributing to this challenge.

1) Reliable electricity supply is essential for powering technological devices and facilitating their usage across various sectors. Unfortunately, Zambia continues to grapple with frequent power outages and an insufficient power grid that restricts its ability to fully utilize technology.

2) Limited internet connectivity hinders access to information and inhibits communication channels necessary for leveraging technology-driven solutions. The population's ability to benefit from e-commerce platforms, digital education resources, or telemedicine services is severely hampered by this lack of connectivity.

3) An underdeveloped transportation network poses challenges in distributing technological equipment efficiently across different regions within Zambia. This results in delays and increased costs associated with procuring necessary devices or components required for implementing advanced technologies.

By critically analyzing these issues surrounding insufficient infrastructure for technological advancements in Zambia as highlighted in the article's conclusion section, we can gain valuable insights into potential solutions that can address these challenges effectively.

### Inadequate Facilities for Technological Development

One of the most pressing issues highlighted in the article "Challenges of Technology in African Countries: case study of Zambia" is the insufficiency of infrastructure to support technological advancements. The author adeptly paints a vivid picture of a nation struggling to keep up with the rapid pace of technological innovation, leading to numerous hurdles and setbacks. The lack of proper infrastructure has created a perplexing situation where Zambia finds itself lagging other countries in harnessing the full potential of technology.

The burstiness and perplexity surrounding this issue are evident as the author describes how inadequate internet connectivity hampers progress in various sectors. With limited access to reliable internet, businesses are unable to fully capitalize on e-commerce opportunities, hindering their growth potential. Moreover, education suffers greatly as students struggle to access online resources and participate in digital learning platforms. This not only perpetuates an unequal educational landscape but also stifles the development of future generations who will be expected to navigate an increasingly digital world.

Additionally, the lack of sufficient technological infrastructure poses serious

challenges for healthcare delivery in Zambia. The author highlights how remote areas face significant barriers when it comes to accessing quality healthcare services due to limited connectivity and outdated equipment. This dire situation exacerbates existing health disparities, making it even more difficult for marginalized communities to receive adequate medical attention.

Furthermore, insufficient infrastructure impedes innovation and entrepreneurship within Zambia's technology sector. Start-ups and small businesses face an uphill battle when attempting to establish themselves due to unreliable power supply, poor road networks, and inadequate telecommunications systems. This stifling environment discourages investment both domestically and internationally, crippling economic growth prospects for the country.

It is undeniable that insufficient infrastructure poses significant challenges for technological advancements in Zambia. The burstiness and perplexity surrounding this issue are strikingly evident as various sectors suffer from limited internet connectivity, hindering progress in education, business growth, healthcare delivery, and overall economic development. Urgent action is required by government authorities and international organizations to invest in and upgrade the necessary infrastructure to bridge this technological divide. Only through concerted efforts can Zambia hope to catch up with the rest of the world and fully harness the potential of technology for the benefit of its citizens.

In conclusion, the article sheds light on the pressing issue of insufficient infrastructure for technological advancements in the country. The author effectively highlights the various challenges faced by Zambia, ranging from limited access to electricity and internet connectivity to inadequate funding and skilled personnel. These obstacles have significantly hindered the development and utilization of technology in various sectors, including education, healthcare, agriculture, and business.

One of the key takeaways from this critique essay is that without a robust infrastructure in place, technological advancements cannot be fully embraced or leveraged to their full potential. The lack of reliable electricity supply has impeded progress in rural areas and disadvantaged communities where access to basic services is already limited. Furthermore, without widespread internet connectivity, individuals are unable to tap into information resources or engage in online platforms that could enhance their skills and knowledge.

The article also emphasizes the importance of addressing these challenges through increased investment in infrastructure development. It is crucial for both government bodies and private sector entities to collaborate in order to provide reliable power supply and expand internet coverage across all regions of Zambia. Additionally, efforts should be made to enhance digital literacy among citizens while simultaneously encouraging entrepreneurship initiatives that can drive innovation.

In conclusion, addressing the issue of insufficient infrastructure for technological advancements must be prioritized by stakeholders in Zambia. By doing so, not only will technology play a pivotal role in transforming key sectors such as

education and healthcare, but it will also stimulate economic growth and improve overall quality of life for Zambian citizens.

### Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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