

ICT in Education: Mapping Digital Learning Initiatives in Tanzania

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Abstract

The digitalization of education Systems has long been a theme of long discussion all over the world. It guarantees enormous picks in students if created and actualized accurately. It gives good quality of instruction, higher proficiency and higher levels of inclusion and inspirations from both the students and the instructors. This study aimed at identifying key technology integration and digital learning initiatives implementation as well as mapping all partners working in supporting basic education in Tanzania in respect to ICT (Internet Communication and Technologies). A variety of methodology tools, such as desktop literature reviews, quantitative analysis, face-to-face online google form link, questionnaires, and telephone interviews, were used to accomplish the study's goals. Particularly, these methods of data collection made it possible to thoroughly examine primary and secondary documents, conduct contextual analysis, and investigate individual and organizational perspectives. All of the empirical and factual data used in the study came directly from stakeholder interviews and previously published research. Data were gathered from 306 secondary schools and 381 primary schools through the use of a repeated cross-sectional survey. Data were analysed using a general-purpose statistical software package, SPSS, [1]. Findings reveals what is existing, what works and what not and which direction should be taken. The study presents assessment of technology integration options for rural and urban schools with a consideration of the challenges identified. Further the study recommends, cost of investment in technology in education to Tanzania context and how best can the country reap the benefits of investment in technology for education and concludes by putting forward the strategies required in investing in technology.

Keywords: ICT, Basic Education, Learning Technologies, Access to ICT, learning and teaching.

1. Introduction

Tanzania has all the advantages of a "late adopter" of technology for basic education, despite being in the "acquisition" stage. After the initial use of technology

in education, Tanzania moved "straight into mobile technology" and "new software economy models"

Quickly. It has many advantages over nations that have invested in wired and fixed technology infrastructures [2]. Now is the time for Tanzania to strategically choose specific niches from which to develop clusters of competencies that make sense in the context of Tanzania and East Africa. Tanzania is located in a new advantageous zone for the development of high-quality students with the necessary skills for the global ICT industry as a result of the massive expansion of the basic education system currently ongoing. It is possible to quickly respond to basic educational technology needs and provide the regional integration in ICT usage for basic education that has been cited as a challenge for African development with the appropriate investment in innovation, infrastructure, and coordinated efforts.

The use of digital technology in education has emerged as a primary means of preparing students for this changing environment. Recognizing the potential of digital technology to improve the delivery and quality of education, teacher training and student performance, the Tanzanian Government has launched the First National Telecommunications Technology (ICT) Policy in 2003 [3]. ICT is therefore taught as a subject at various school levels and used to improve teaching and learning. Harnessing the benefits of technology in quality education requires effective use of teachers trained in the educational use of technology.

Since the formulation of the ICT Policy in 2003, several technological, institutional and structural changes have occurred globally, nationally and nationally that affect the development of ICT in education. The country adopted his ICT National Policy in 2003, identifying infrastructure development as a key factor in the development and use of ICT within the country and its contribution to Education [4]. The liberalization of the telecommunications sector gave a great boost to the development of telecommunications. As the country becoming more aware of the potential of ICT presented in improving education the quality and access to education is increasing. The government eventually decided in 2007 that the formulation ICT

policy among others to be inevitable in building and introducing ICT into the education sector.

Consequently, a number of gaps have been noticed in the course of implementing the Policies which calls for need of transforming Tanzanian education from ICT in Education to digital learning. Among other the gaps include:

- i. Outdated ICT in Education policy which doesn't not recognize the technology transformations such as the use of smartphones to support learning.
- ii. There is no ICT in education strategy which can guide the implementation of the ICT in the country and help the government to self-evaluate on the level of implantation of its programmes.
- iii. ICT and Digital learning in the country are implemented in pockets, based on small projects, with limited government control of the programmes.
- iv. Absence of ICT standards and tips, which has led to duplication of technologies and platforms.
- v. inadequate monetary to facilitate ICT related activities within the organization, which include lack of incentives to inspire ICT creativity and innovation.
- vi. Absence of ICT steering framework to oversee ICT operations, secure ICT environment, ICT funding decisions, responsibility, and the tracking of ICT initiatives.

In view of the above-mentioned gaps the study will conduct the relevant mapping of the existing ICT Digital learning programmes in Tanzania for nation to achieve excellent educational sector results and services through the development and use of ICT application that describe the rationale for the ICT policies and proposed digital transformation.

It is important to note the acknowledgement and efforts made by the nation. In a number of policy papers, the government demonstrates its commitment to utilizing information and communication technologies (ICT) to address a variety of educational issues. Technology (ICT) is portrayed as a potent development facilitator in the fight against poverty, ignorance, and diseases in both national policy documents (National ICT Policy, Vision 2025, and NSGRP) and sector policies (ESDP). In addition to spending money on technology (ICT) promotion, the government is obligated to establish compatibility standards. According to a number of government economic development strategies, the government should encourage investments in ICT development from all sectors [5]. According to Hamad, the Ministry of Communication, Science, and Technology was established by the government to, among other things, foster the investment, introduction, and utilization of ICT in national development initiatives and government operations.

In addition, on September 12, 2021, the Ministry of communication and Technology was established to

coordinate Tanzania's digital transformation initiatives in respect to fourth world-wide digital revolution phases. The ministry is also mandated to formulate and demonstrate implementation of policies on information technology, technology innovation records, Telecommunications, Postal and ICT countrywide Broadband spine (NICTBB:) performance development and improvement of human sources; and oversee Ministerial Departments, Parastatal companies; groups and initiatives beneath its docket. The Tanzania know-how community (TAKNET) became initiated in 2009 with the help of the United international locations under the only UN with aim to facilitate the advent, dissemination, and alertness of expertise in crucial development areas. That, amongst different things, targeted on how ICT can enhance the livelihoods of poor in the rural areas.

In order to remain competitive and retain the pace of ICT utilization in education sector the government needs also to find ways of increasing applications of technologies to basic education. The efforts in place between the rural and urban digital connectivity have never been so clearly marked, much less talk of academic literature highlighting the high benefit of ICT in all facets.

2. Literature Review

Existing education policies, strategies and implementation frameworks embrace the use of technology for teaching and learning; however, most of these policies are outdated and still focusing on ICT as a hardware with training on how to use it, but not on ICT as a device and a software to support learning. While there is a national ICT in education policy of 2007, there is no ICT implementation strategy that was ever developed, nor a guideline for ICT integration in education. ICT in the education is mainly used for ICT skills training rather than for pedagogical.

Tanzania's National ICT Policy acknowledges a global shift from industries based on natural resource products toward knowledge based and human resource intensive goods and services. However, the applications of ICTs have primarily focused on infrastructure and less on ICT- related learning opportunities. Among the worst practices have been the placement of hardware in schools without relevant e-contents, the adoption of ICT- related models and practices from developed countries in the hope that they will work, and the lack of a clearly defined ICT in education implementation plan and framework [4].

Despite the tremendous possibilities and benefits provided by ICT, there are a plethora of issues to be addressed in successfully integrating ICT into the education system in relation to the aforementioned initiative [6] ICT, like any powerful tool, has the potential to cause as much harm as good. Bad pedagogy implemented on a computer may have its

negative effects multiplied many times over due to the technology's power.

The revolution in information and communications technology has resulted in the knowledge society. Teknolojiaya Habari na Mawasiliano (TEHAMA) has used it in some primary and pre-primary education to develop an ICT curriculum in Tanzania [7]. However, ICT is only taught in a few urban schools and near district headquarters where institutions have access to electricity.

At the Ministry of Education, Science, and Technology (MoEST), the President's Office Regional Administration and Local Government Authorities (PO-RALG), and the regional and district offices, computers have been installed in an EMIS and SIS system. Additionally, training for educational managers at these various levels has been finished. As a result, the Basic Education Statistics in Tanzania (BEST) and annual publication now uses the EMIS and SIS systems to collect, analyse, and publish education data and information [21].

The National Examinations Council of Tanzania (NECTA) began processing examinations in 1998 with the use of ICT for exam setting and marking. At the moment, interactive web portals are being used to distribute exam results and provide application forms and information on CD-ROMs.

The study discovered that the Tanzania Institute of Education (TIE) has a number of projects that collaborate with communities to collect educational data that is useful and relevant. Technical assistance and professional support for school administrators and education officials are the primary goals of some of the programs, such as CREATIVE. According to Willingham et al. [41], teachers receive training in phonics-based reading instruction, active learning pedagogy, classroom management, and incorporating e-content into lessons.

ICT training for in-service teachers is also being offered through Teacher Colleges, which boast impressive infrastructure. According to Johnson et al. [17], teachers and educators have received training on how to use information and communication technology (ICT) in the classroom, but all accounts suggest that this training focuses on basic ICT skills. Based on Cisco certification, advanced ICT training has been offered to two to four tutors in each college.

The Vocational Educational Training Authority (VETA) centers offer courses in everything from network administration and technical maintenance and support to basic ICT literacy. VETA is working on plans to construct an ICT center of excellence in Dar es Salaam.

Digital learning environments are currently utilized by the University of Dar Es Salaam (UDSM) and the Open University of Tanzania (OUT), two Higher Learning Institutions (HLIs). However, there a number of universities that provide teachers and students with general ICT training. In addition, the

Tanzania Commission for Universities (TCU) has developed guidelines for Online and Blended Delivery Modes of Courses for Universities Institutions in Tanzania. These guidelines were developed in response to the rising prevalence of new diseases like the COVID-19 pandemic, as well as the increased use of mobile devices and the internet by staff and students at universities (2020). According to Johnson et al. [17], the actual integration and exploitation of ICT to address issues of access and quality appears to be extremely limited, with the exception of basic ICT skills training and a limited use of e-learning at UDSM and OUT. At least at the university and teacher preparation levels, there are indications that this is about to change. Even though OUT has implemented technology integration in education to its fullest extent, both UDSM and OUT continue to experiment with various e-learning strategies and tools.

The MoEST is looking into ways to use the ICT infrastructure that is already in place at teacher colleges to expand capacity for pre- and in-service training in order to address the issue of teacher shortages.

According to Daudi and Nzilano's research in [11], teachers are eager to learn about and utilize ICTs, but they are hindered by both internal barriers (such as personal attitudes, skills, and perceptions about a technology) and external barriers (such as access to hardware and software).

The teacher competency levels in ICT could not be determined. Majorities are poorly prepared in ICT use and eventually could fail to mix digital and non-digital technologies in classrooms when enabled. Ghavifekr et al. [12], study portrays that secondary school's complex issues in ICT use cannot be addressed in a single direction.

In addition, the implementation and long-term viability of ICT in education can be extremely costly in terms of both human and financial resources. According to the research that was conducted in Tanzania, educational leaders and planners face the challenge of ensuring that the introduction of ICT into the classroom is managed carefully so that the potential benefits are realized while the risks are minimized or eliminated, maximizing the benefits of such substantial investments. However, as a result, careful planning is required [12].

3. Methodology

The digital mapping accurately depicts the complexity and involvement of the basic education ICT mapping industry in Tanzania and provided sufficient detail for the government to take appropriate action toward education stakeholders, partners, and training providers.

A desk review, in-person and telephone interviews, and a mixed methodological approach were used to accomplish the study's goals.

Particularly, these methods of data collection made it possible to conduct in-depth research, consider perspectives from both individuals and organizations, conduct context-based analysis, and carefully examine primary and secondary documents. All data used in this study is empirical and evidence-based, derived directly from stakeholder interviews and previously published research. The desk review of this study focused on digital technology and teaching in primary and secondary schools in the United Republic of Tanzania. Specifically, researchers examined reports from organizations and governments, policy documents, published studies, and media reports and synthesized the available evidence.

In addition to the literature review, the researchers also conducted interviews with key informants, including Educators (availability and use of digital technology, teacher salaries, working conditions, education and training), education sector Government officials (availability and use of digital technology, technology-related priorities in education), planning, consultation with teachers) on educational issues and

teacher salaries), individual parents of children enrolled at various school levels (involvement in policy decisions, strategies to improve teacher skills, availability of teachers and the like. Interviews were also conducted with private school owners on how to improve their sector and digital skills status.

Furthermore, data for the main study were collected through a questionnaire in Microsoft Word format (See Appendix 1) and respective online google form link were shared to private companies, NGOs, government agencies, and all head of primary and secondary schools in Tanzania through President's Office Regional Administration and Local Government (PO-RALG). The study identified 13

government institutions collectively involved in digital initiatives in education, 687 head of primary and secondary schools from 26 regions in Tanzania, and 10 private companies, NGOs, and Donors (See Figure 1). The collected data were organized and analysed thematically to respond to the objectives of this study.

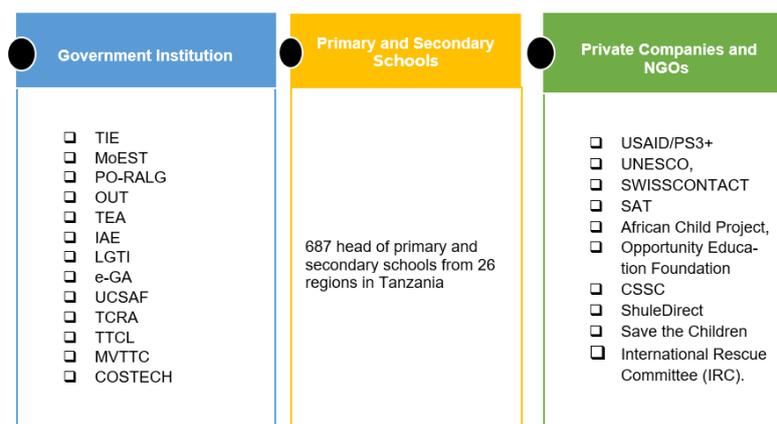


Figure 1. Institutions Responded to this study

4. Key technology Integration and Digital Learning Initiatives Implemented by Different Partners in the Country

Overview of Primary and Secondary Education in Tanzania - Through the formulation of appropriate policies and the provision of funding, the Tanzanian government is obligated to provide its population with education. Local governments are in charge of education administration, but the central government is still largely in charge of policy formulation and funding. The structure of the formal education and training system includes two years of pre-primary education, seven years of primary education, four years of lower secondary education, two years of upper secondary education and at least three years of tertiary education [26]. There are technical secondary schools in addition to regular stream secondary schools, where students learn both technical and

standard secondary school subjects. The cycle of technical secondary schools takes four years to complete.

Table 1 shows the number of private and public primary and secondary schools in 2019. According to the Government of the United Republic of Tanzania 2019, 8 out of 3,742 public secondary schools are technical secondary schools [19].

Table 1. Number of primary and secondary schools in United Republic of Tanzania

Category	Primary	Secondary
Public	16 223	3 742
Private	1 581	1 259
Total	17 804	5 001

(Source: Government of United Republic of Tanzania 2019)

The government has introduced free primary education, which prohibits students from paying tuition fees for public kindergartens, primary schools, middle schools, and technical high schools. The education industry faces a number of significant difficulties, including lack of educational facilities, teachers, books, and learning materials in rural areas; inadequate funding and wages; as well as a lack of digital resources and expertise in pedagogical technology use.

ICT use, Internet, and Electric Power Status in Primary and Secondary Schools - From the presented Tanzania maps, the study did cover primary schools (see Figure 3) and secondary school (see Figure 4) initiatives with an attempt of mapping and deepening the work done by partners and government on adoption of ICT for learning, remote assessment and how education systems can be more effective. A major part of this work was developed as a new strategy for synchronization of existing efforts in Education systems to support more effective use of ICT. The results presented are more confined to the areas allocated within the maps as ongoing study

covered both private and public schools (reached 687 head of primary and secondary schools).

Throughout the research, concerns were raised about exploring teacher competencies frameworks, teacher networks and innovative teacher communities to assist countries in teacher empowerment. Teachers are still central to learning, especially in technology-rich environments. There is a growing concern that students are falling victims to the learning using technology due to the fact that teachers are not engaging them to use of technology due to teachers' technological inability.

Spatial placement of mind maps is key in this study because it helps us get a better overview, make new connections more visible, and create endless thoughts, ideas, connections, and associations about each topic used in this study. Therefore, adding images to your map can also aid in this process by acting as visual stimuli. As a result, representations of geographic relationships and locations of key partner initiatives are displayed in reduced size while maintaining proportionality can be view at the dashboard appended to the Appendix 1.



Figure 3. ICT Use, Internet, and Electric Status in Primary Schools by Regions



Figure 4. ICT Use, Internet, and Electric Status in Secondary Schools by Regions

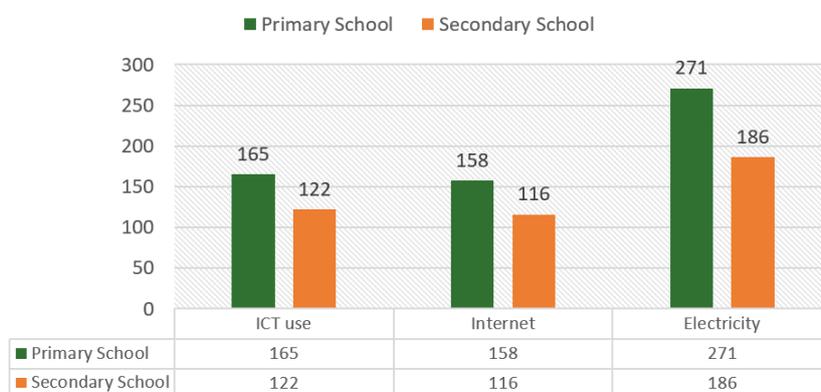


Figure 5. Digital Initiatives Coverage by Regions

To give a clear quick overview the study extracted the collected data in presented maps and presented them using bar chart. Bar chart representations in (see Figure 5) is from the data combination from the map's information collected from the regions visited highlighting the enabling existing facility to facilitate ICT applications to primary and secondary education. The concentration was on three aspects, availability of Internet, Electricity, and ICT use locations. The availability of the Internet, locations for ICT use and electricity the bar chart were used to present the three focal points used. When presenting geospatial data along values, it is very helpful. The height or volume of each bar is proportional to the values it represents, just like in a bar chart.

Digital learning initiatives implemented in the Country - Our review of Tanzania's policies and strategies demonstrated that most of the development partners in education have vested interests in countries' digital agenda. These are found as legal entities, stand-alone digital strategies efforts, as sections of national development plans or within aspects of other initiatives such as collaborations. In this study reached and examined key players that considering which digital initiatives or technology has been implemented. However, it was further categorized in two groups for more clarifications, 9 government Institutions and 5 private companies and non-Governmental organizations (see Table 2).

Table 2. Digital learning initiatives implemented in the Country

INSTITUTION	DIGITAL INITIATIVE	DESCRIPTION
President's Office Regional Administration and Local Government (PO-RALG)	School Information Systems(SIS) [27]	SIS is a school-oriented system that provides school data collection, school data management, handle all administrative and schools' supervision processing and aggregated reporting, at the school and upper levels. It is available in both mobile (Android) and web application.
Tanzania Telecommunication Company Limited (TTCL)	National ICT Broadband Backbone (NICTBB) [28]	All district and regional headquarters in Tanzania are connected by enabling ICT infrastructure that supports internet connectivity. February 2009 marked the official start of the project. Everything we know about e-government, e-learning, e-health, e-commerce, and so on has been redefined by NICTBB thus far and contributed to enhancing the delivery of e-services, including in the education sector.
Tanzania Institute of Education (TIE)	Online Library [29]	This initiative dedicated to pupils and students of the Tanzania's Distance learning community emerged during outbreak COVID-19 pandemic in Tanzania. TIE provided online resources (Textbooks, Literature books, and reference books), professional support, and guidance to all pupils and students whenever, and from wherever they have chosen to study. It accessible through both web and mobile application.
	TCPD e-learning [30]	This system enables teachers to learn a variety of modules in order to increase the knowledge of the subjects they teach and the best teaching methods. It is a Teacher Continuous Professional Development (TCPD).
Universal Communications Service Access Fund (UCSAF)	School Connectivity and ICT support for Girls and Young Women [31]	In order to achieve social economic development in accordance with the objectives of Tanzania's development vision for the year 2025, UCSAF works in partnership with stakeholders in the sector to facilitate and coordinate communication services access to underserved urban and rural areas.
Institute of Adult Education (IAE)	<ul style="list-style-type: none"> • SDF Learning Management System [32] • IAE-e LMIS [33] • Student Academic Register Information [34] 	For students enrolled in certificate, diploma, and post-primary education, the Centre for Learning, Research, and Training in Adult Education offers courses leading to degrees, certificates, and diplomas. Through the establishment of regional centers in 26 of the Mainland Tanzania's regions, it has been able to bring its services down to the local level.
Local Government Training Institute (LGTI)	Establishment of ODeL practice for Councillors and newly employees at Local Government Training Institute (LGTI) [35]	LGTI together with PO-RALG, PO-PSM and USAID/PS3+ activity, established Open and Distance e-Learning (ODeL) approach for delivering training to councillors and newly employers at Local Government Authorities. They developed digital enhanced study materials and furthermore, a learning management system which manages the actual teaching and learning process.
Morogoro Vocational Teachers Training College (MVTTC) TVET e-learning portal	Morogoro Vocational Teachers Training College (MVTTC) TVET e-learning portal [36]	MVTTC TVET e-learning portal, provides access to tutors and instructors of Vocational colleges to learn pedagogy skills and integration of ICT in VET programs.

INSTITUTION	DIGITAL INITIATIVE	DESCRIPTION
ShuleDirect	<ul style="list-style-type: none"> Shule Direct’s Learning Management System (LMS) Online Access [37] Shule Direct Classroom Website [38] ShuleDirect Mobile Apps Available in PlayStore and iStore MAKINI SMS USSD Code 15070 ShuleDirect Kids for Primary School App 	In Tanzania's secondary schools, qualified educational content is delivered via the Web and mobile platforms as a supplement for learning and revision for students and as a teaching resource for teachers since its inception in 2013.
Opportunity Education Tanzania	Quest Forward Learning [39]	Project to support digital learning in 20 secondary schools in 5 regions (Arusha, Dar es Salaam, Kilimanjaro, Tanga and Zanzibar) with plans for continued program expansion.
Africa Child Project (ACP)	School Connectivity Project [40]	Through the School Connectivity pilot project (also known as "School Connect"), ten government secondary schools in urban and rural Tanzania were connected to "Internet Lite" and a dependable school server that offered students a digital education platform.

5. Key Education Technological Integration Partners in Tanzania

The study identified fourteen (14) technology integration in education partners currently operating in Tanzania. These partners play distinguishable roles in integration of technology in education, those roles range from formulation of education technology guidelines, policies, standards, provision of internet services, implementation of education technology, and monitoring of education technology initiatives in Tanzania. These partners are clustered in government and private clusters. Table 3 shows the Government Digital Initiative Partners, their roles and cluster in implementation of technology in education in Tanzania. The finding of the mapping of partners in

technology integration in education were categorized according to four core attributes of the technology integration in education partners in Tanzania (see Table 4) which are policies, guidelines and standards attribute, connectivity/internet service providers attribute, implementers of education technology attribute and monitoring of education technology attribute (see Figure 6).

Challenges of investing in digital learning and technology integration in education in Tanzania - When it comes to investing in digital and other aspects of education, the government of Tanzania has made a remarkable and beneficial contribution. During the colonial era, education in Tanzania was based on Westernized education models. Around the 1840s, Christian missionary schools started coming to

Table 3: Technology integration in education partners in Tanzania (Government Institutions)

PARTNER	CLUSTER	ROLE IN IMPLEMENTING TECHNOLOGY INTEGRATION IN EDUCATION
Ministry of Education, Science and Technology (MoeST)	Government	<ul style="list-style-type: none"> Formulation of policies in education and technology in education. Promotion of Application of Science and Technology. Play a role in designing, implementing and enforcing digital initiatives in education.
President’s Office Regional Administration and Local Government (PO-RALG)	Government	<ul style="list-style-type: none"> Implementation of Digital policy in primary, secondary, and tertiary education
Tanzania Institute of Education (TIE)	Government	<ul style="list-style-type: none"> Ensuring the quality of basic education Development of ICT syllabuses for primary education, secondary education, and teachers’ education Integration of ICT in primary and secondary education Established studio for recording learning content Development of curriculum materials Approval of learning and teaching materials
National Examinations Council of Tanzania (NECTA)	Government	<ul style="list-style-type: none"> Implementation of examinations conducted through technology. Releasing of examination results via technology enhanced means.
Tanzania Education Authority (TEA)	Government	<ul style="list-style-type: none"> Securing funding for financing education sector in Tanzania, including digital initiatives
Commission for Science and Technology (COSTECH)	Government	<ul style="list-style-type: none"> Managing research activities in science and technology including digital initiatives in education

Tanzania Telecommunication Company Limited (TTCL)	Government	<ul style="list-style-type: none"> Contributing to achieve the delivery of connectivity to primary and secondary schools to benefit digital education in collaboration with mobile network operators.
Institute of Adult Education	Government	<ul style="list-style-type: none"> Provides virtual education for out of school youths and adults
Universal Communications Service Access Fund (USCAF)	Government	<ul style="list-style-type: none"> To facilitate and coordinate school connectivity program, and broader mandate to extend access to communication services to underserved areas.

Table 4: Technology integration in education partners in Tanzania (Private companies and NGOs)

PARTNER	CLUSTER	ROLE IN IMPLEMENTING TECHNOLOGY INTEGRATION IN EDUCATION
Vodacom Tanzania PLC	Private	<ul style="list-style-type: none"> Contributing to achieve the delivery of connectivity to primary and secondary schools to benefit digital education. Through the Instant Schools platform, which is also known as the E-Fahamu project in Tanzania, free access to online educational resources is provided to students.
Opportunity Education Foundation (OEF)	Private	<ul style="list-style-type: none"> Implementing Quest Learning platform which emphasizes on learning in action, practice, collaboration, flexibility, and personal growth.
Africa Child Project (ACP)	Private	<ul style="list-style-type: none"> Contribute to the mapping of all schools offering basic education and establishing sustainable models for school connectivity in Tanzania and hence answer the demands in resource constraint environments. Connect secondary schools to internet. Ensuring free access to digital learning contents to students and establish the path towards a nation-wide sustainable model for school connectivity in Tanzania
Christianity Social Services Commission (CSSC)	Private	<ul style="list-style-type: none"> Facilitate social services, concentrating primarily on the health and education programs offered by Churches that are members.
TIGO Tanzania	Private	<ul style="list-style-type: none"> Facilitate the deployment of internet access points in secondary schools throughout the nation to complement e-schools.

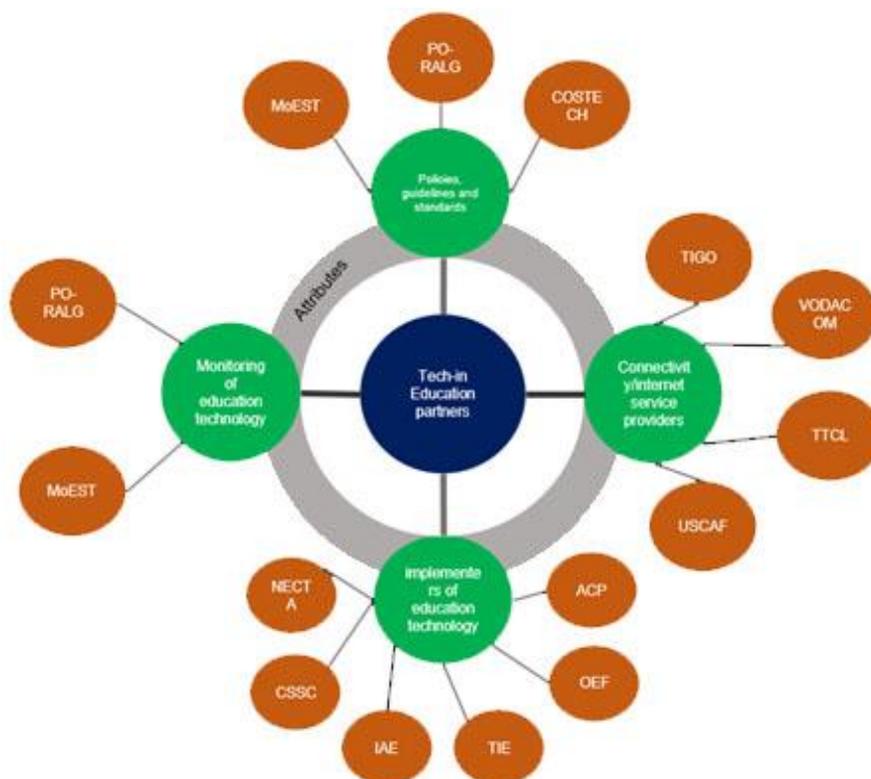


Figure 6. Technology integration partner's attributes and relationships

Tanzania to teach the white population western and Christian values (1980). It was thought that teachers would only be able to help the community thrive and impart satisfactory knowledge to students when they had sufficient skills and abilities. The fact that, for the first time in the basic education plan in Tanzania, the Education Sector Development Plan known as (ESDP 2016/17 – 2020/21), [27] covers all sub-sectors of education—basic education, secondary education, teacher education, higher education, and vocational education — in both formal and non-formal settings is a significant accomplishment. This contrasts with the ESDP that came before it, which only addressed digital inclusion in education for higher education institutions only.

A good number of teachers presently have ICT basic skills, especially young teachers whereby others are making use of technology after acquiring different training skills through on job training or short courses. Due to the digital revolution acquisition from pre-schools levels, some students have been taught how to assess authenticity of online material at early age. The COVID-19 pandemic, which had largely disrupted the continuity of educational delivery and required educators to respond quickly to online learning, greatly exacerbated this. However, there are a number of policies and frameworks in place to support the integration of ICT, including the Government's ongoing education policy reform.

In spite of the significant improvement in ICT in training that we have reached, there are difficulties in putting resources into advanced learning, which can be categorized in two sections, those that are concerns with strategic issues connected with government needs, monetary assets distribution, local area mindfulness and the second part is got to do with stakeholder involvements are among the major challenges within this category.

A lack of sufficient financial resources to support the implementation of a specific policy strategic plan following shifts in priority, according to the study, has hampered digital adaptation. There are excellent policy guidelines that point to improved educational outcomes. However, the government simply cannot afford to make a significant investment in their implementation at once or within a given time frame. Also, when making decisions, most decision-making bodies do not think about how important it is to involve or educate the community about new policies. Instead, they develop the policy without consulting the community until it is ready to be implemented. In turn, this makes it difficult for the community to accept the policy or its modifications, and educational policies are no exception [10].

A further subcategory focuses on technical issues, specifically out-of-date curriculum. This is the most pressing issue of recent times, resulting in a gap between the output of higher education institutions and the requirements of the labour market. The lack of direct connections between industries and

inadequate or out-of-date curricula exacerbates this disparity. As a result, technology transfer and its use in economic activities are lacking, requiring immediate attention from policymakers, decision-makers, and low-level policy implementers, according to [23].

According to Haydon et al. [14], the implementation of dependable and efficient policies to facilitate and accommodate these kinds of transitions and challenges is necessary for the need for a smooth transition and adaptation of new methods of delivering and acquiring skills and knowledge. As a result, it is essential to examine the significance of educational policies, as well as the obstacles they may face and any roles they may play, as well as the Perspectives of stakeholders in the education sector.

On the other hand, the study identified several challenges of investing in digital learning and technology integration in education sector. The challenges facing integration of technology in Tanzania have been categorized in four categories by researchers in this study. The categories are: Digital skills training and development for teachers; Pedagogical use of technology; Ethical and critical use of digital technologies; Infrastructure supporting digital learning; Regulatory and policy frameworks; and Technical and managerial support. The latter challenges are discussed below:

Digital skills training and development for teachers -This category addresses the knowledge and skill gap among teachers who are incorporating technology into education. Digital skills training and development for teachers according to the findings of this study, the majority of educators who are at the forefront of implementing technology in education do not possess the necessary technology skills or knowledge. Additionally, it was discovered during the course of this study that teachers receive insufficient initial training on how to use digital technologies in teaching, learning, and education administration.

Pedagogical use of technology - Pedagogy as it is defined as the art or science of teaching and educational methods. In addressing pedagogy as the challenge in investing in digital learning and technology integration in education in Tanzania. The study identified that technology has brought new methodologies for teaching and learning such as collaboration, blended learning, enriched learning materials, assorted and flexible learning opportunities for learners, yet the teachers embrace the traditional methods of teaching. In this study it was reported that there is a lack of continuous and lifelong training on digital skills and use of technology to teachers, limited access to digital tools and facilities, and an indication that teachers do not want to show their weakness on technology/ICT skills which leads to resistance to adopt digital pedagogy and integrating technology in education.

Ethical and critical use of digital technologies - Digital technology integration in education as the emergent field from Information and Communication Technologies (ICT). Such that ICT has a number of applications in different industries ranging from business, education, industrial processing, and social networking to mention few of them, also ICT as the matured field it has its effective operational guidelines. Therefore, the study identified that the key practitioners of integrating technology in education have much invested in the use of technology on other areas such as administration of education (administration information systems), mailing and social networking (chatting and information sharing), having focus on these areas hinders the success of technology integration on the core education business which is teaching and learning, also hinders the movement of formulating guidelines which supports effective use of technology in education.

Infrastructure supporting digital learning - Integration of technology in education is supported by appropriate infrastructure investment. The infrastructure in technology integration in education is referred to the devices for accessing and delivering educational resources, internet devices, bandwidth, and electricity. It was echoed in this study that there is a shortage of ICT equipment such as computers, smartphones, digital cameras, and white boards. Also, the study identified insufficient internet connectivity to most of remote areas in Tanzania, in line with this inconsistent electric supply which hinders the success of technology integration in Tanzania.

Regulatory and policy frameworks - The study also identified gaps in policies and regulatory frameworks in integrating technology in education, those gaps are in opportunities for funding digital learning activities in schools, digital pedagogy, maintenance of digital infrastructure, lifelong learning for teachers, and skills upgrading for teachers. On the other hand, the study identified that policies which

Supports technology integration in Tanzania are outdated and do not suit the current demand of education technology.

6. Assessment of Technology Integration Options for Rural and Urban Schools with a Consideration of the Challenges Identified

Financial, social, and infrastructure-related obstacles abound in Tanzania. However, when it comes to challenges and integrations, the presentation of the same basic education concept in urban and rural settings differs slightly. The recent increase in enrolment overwhelms the available resources—classrooms, teachers, and textbooks—but technology can reduce its rampage effects. Notably, there are issues with technology planning, including inadequate planning that result in a lack of relevant educational e-content, facilities, and qualified teachers who can teach with ICTs [11]. Again, problems like a lack of electricity and a shaky power supply could make it hard to use solar power or other alternative energy sources in both urban and rural areas. The study revealed that the cost of equipment and hardware continues to be a significant barrier to the physical delivery of e-LMS resources to users' homes, assuming they have computers and a client-server LAN architecture that makes it simple to access and use cloud storage for educational resources via an identified hot spot. For the challenge of learned human resources – providing pedagogical training for teachers and technicians, rather than simply training them to use an ICT tool which goes hand in hand with intensifying the sector can be leveraged to respond to the challenge. More so in consideration to identified challenges assessing the technology integration options for rural and urban schools in Tanzania the study used the matrix form to present the findings of challenges and technological integration option for urban and rural schools (see Table 5).

Table 5. Assessment of technology Integration option for rural and urban schools

Challenge	Technology integration option(s)	
	Urban schools	Rural schools
Digital skills training and development for teachers	<ul style="list-style-type: none"> Provision of in-service teacher’s training on ICT, the training can be offered in an online learning management system. Establishing television and radio programs in ICT, digital pedagogy and technology integration in education. 	<ul style="list-style-type: none"> Provision of in-service teacher’s training on ICT, the training can be offered through offline accessible technology such as the materials to be stored in CDs or Flash disks. Establishing television and radio programs in ICT, digital pedagogy and technology integration in education.

Pedagogical use of technology	<ul style="list-style-type: none"> Establishing television and radio programs in digital pedagogy and technology integration in education. Provision of hand-out materials (in hard-copy/soft-copy) which details digital pedagogy. Establishing a professional e-forum/website of teachers/education practitioners which will be discussing issues related to digital pedagogy. 	<ul style="list-style-type: none"> Establishing television and radio programs in digital pedagogy and technology integration in education. Provision of hand-out materials (soft-copy) which details digital pedagogy. Establishing teachers/educators' knowledge hubs whereby teachers and education practitioners will meet and discuss issues related to digital pedagogy.
Ethical and critical use of digital technologies	<ul style="list-style-type: none"> Establishing a professional e-forum/website of teachers/education practitioners which will be discussing issues related to ethics and productive use digital technology in education. Provision of soft-copy/hard-copy material which detail issues on productive use technology in education and ethics. 	<ul style="list-style-type: none"> Establishing teachers/educators' knowledge hubs whereby teachers and education practitioners will meet and discuss ethics and productive use digital technology in education. Provision of hard-copy material which detail issues on productive use technology in education and ethics.
Infrastructure supporting digital learning	<ul style="list-style-type: none"> Establishment of a Virtual Learning Environment (VLE), where student and teachers can meet online and perform the learning/teaching process. Both mobile phones (smartphones) and computers are suitable for supporting digital learning in urban areas due to the reliable electricity and ease access to devices. Offline and online mobile education applications with offline online data synchronization. Complex multimedia education components can work effective in urban areas due to the availability of reliable internet connectivity. Establish Mobile learning mobile portal will aid students to access learning resources and perform learning activities online. Chunked and either online or offline referenced education content is suitable for urban schools, this will add on focus towards learning and provide diverse means of learning. 	<ul style="list-style-type: none"> Establishment of physical digital learning spots/hubs, where students and teachers can gather and access digital education resources. Mobile phones (smartphones) are suitable devices for accessing digital education resources in rural schools since they have ability to store electricity for more than 8 hours. Offline mobile education applications with offline online data synchronization or fully offline mobile apps. Textual and simple graphics digital education contents are suitable for rural areas due to the limitations of internet coverage in rural areas. Establish Unstructured Supplementary Service Data (USSD) education learning portal which will aid students to access learning resources and perform learning activities in absence internet. Chunked and offline referenced digital education content is suitable for rural schools, to bring focus and omit the internet challenge. There are various platforms hosted in the cloud/self-hosted that offers mobile offline access capability with on time auto download and sync options when internet is available.
Regulatory and policy frameworks	<ul style="list-style-type: none"> Integrated Planning, Policy and Regulations focusing on innovative forms of governance, on policy preparation, and on the right regulatory frameworks that are needed to enable and foster large-scale implementation and roll-out of educational program and schools' solutions. However, alignment of stakeholders is a key to a successful preparation and execution of any school program. 	<ul style="list-style-type: none"> The active engagement of stakeholders, businesses and third sector (education institutions and non-profit organizations) within policy making is a key ingredient to ensure sustainability and local ownership of rural policies.
Technical and managerial support	<p>Each school in both urban and rural areas has its own organizational structure, practices, politics, influence channels, methods of negotiation, administrative roles, student-staff relationship, hierarchies, bureaucracy, processes, codes of conduct, unspoken rules, and working methods.</p>	

7. Cost of Investment in Technology in Education and the Benefits

The findings demonstrate that an education system that takes equality and inclusion into account in education can be realized with the help of an appropriate policy to support integration. According to Haydon et al. the current educational system places an emphasis on the necessity of accommodating all types of learners and educators, who are the ones who actually implement the learning and teaching process, in any form of education or method of

delivering knowledge in any setting [14].

According to Kihozapatrik et al. [44], the lack of a strong strategic implementation plan and a harmonised 159 framework prevented Tanzania from excelling in ICT use in education, despite the existence of an ICT policy for basic education. However, the country can quickly benefit from and excel with the current political will of the government to implement ICT in education.

In contrast, teacher trainees should be provided with the competencies and skills to integrate information and communication technology (ICT)

into their future teaching and learning practices, as the education system demands the use of cutting-edge technologies [30].

Even though it is possible to delay the use of online resources and e-learning models in primary and secondary schools, this can be a cost-effective (ubiquitous) way to reach a large number of people and is not something that can be avoided. Learning, evidence-based policy making and the rapidly evolving world of new technologies all come together when ICT is used effectively in education [24].

It is possible to measure e-learning because of the newness and variety of e-learning models and the complexity of the factors affecting outcomes [25]. However, it is difficult to measure the actual effects of e-learning on students, schools, and education systems in developing nations.

Typically, prior to suggesting the cost of the investment, a variety of suggestions for discussions in a particular setting are made. Although this may not always be the case, these are typically not intended to guide discussions at a higher level about fundamental strategic priorities in the education sectors because they may cause some larger decisions made at higher levels to be rethought. For example, policymakers think about whether to spend money on digital learning resources rather than school feeding programs, how to make the teaching at teacher training colleges better or hiring more teachers. They

also think about whether to spend money on digital textbooks rather than hardware.

7.1. Investment of technology integration in education

In the era of digital transformation agenda in the country, ICT plays an important part as service delivery enabler in Tanzania, education services being one of the sectors dependents on ICT. To testify the recommendation the study present various efforts that have been deployed by the government in collaboration with development partners to support ICT integration in education such as ICT network connectivity infra-structure, digital skills, and pedagogical skills and have proven success in Tanzania. This study recommends two (2) major investments to make technology integration in education easier and successful.

ICT in education policy reform and Curriculum review to include ICT integration in education. At the government level, these investments will provide guidance, enforcement, and institutionalization mechanism of the existing and new technology integration in education and digital learning initiatives [22]. Furthermore, these regulatory and policy frameworks investments with the existing government will from the higher level; will also provide technical, pedagogical, and supervisory

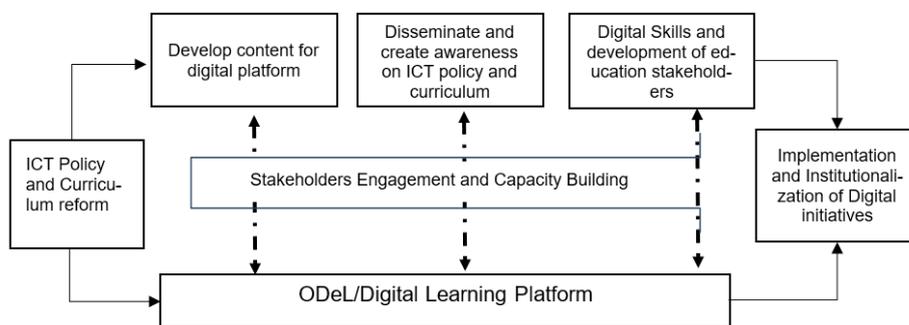


Figure 7. Model for Technology integration partner's attributes and relationships

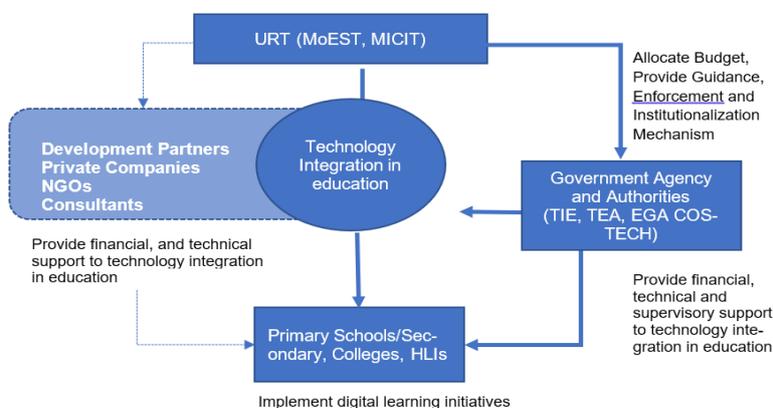


Figure 8. Stakeholders' participation model in Technology Integration process learning initiatives in the country

support to cost effective implementation of digital learning initiatives in the country.

In achieving this mission, Open and Distance e-Learning practices is the cost-effective approach that the government should adopt to disseminate and create awareness of the policy and curriculum reforms pertaining to digital learning initiatives and technology integration in education. In addition, ODeL approach will provide flexible way for policy makers, education specialists, and the key stakeholders to have access to policy and curriculum, digital and pedagogical skills to foster the implementation and effective of digital initiatives in education. The model below presents the implementation procedures.

7.2. Stakeholders Relationship in Technology Integration in Education

In making stakeholders relationship in technology integration in education possible, the (Figure 8) illustrates the responsibilities of key stakeholders and how they will work together in due course of the technology integration in education in Tanzania.

7.3. Cost Effective Benchmark ODeL practices implemented in the country

The proposed approach has been implemented by The Open University of Tanzania(OUT) to two (2) government institutions Local Government Training Institute(LGTI) and Morogoro Vocational Teachers Training College(MVTTC) in Establishment of ODeL based Councillors Training and Self-study in-service teachers training respectively. These initiatives may be adopted by the government in basic and tertiary education levels:

ODeL based councillor's and newly Local Government Authority (LGA) employees training at LGTI - This approach is considered cost effective by the government as it saved costs that were incurred to deliver face to face training approach to councillor's from 185 Local Government Authorities (LGAs). The face-to-face approach had its limitations such as coverage given resources limitation, cost given high number of the Councillors and time given high number of LGAs. Also, the nature of training materials in the used face to face approach was static (printed paper-based materials) and inflexible, The Open University of Tanzania, 2018 (see Appendix 2).

The project was carried out in two phases whereby, phase one focused on ODeL for councillor's training, phase one with investment of 450,000,000.00 TZS. Phase two focused on ODeL for newly employees at LGA which worthied 350,000,000.00 TZS. This project was favoured by the presence of ICT infrastructure present at Local Government Authorities in Tanzania, therefore there

were no purchase of ICT equipment's throughout the project.

Self-study in-service teachers training at MVTTC and NACTE - Due to high demand of the pedagogical skills among teachers from Vocational Training Centers (VTC), establishment of MVTTC e-learning platform played a vital role to provide flexible access to in-service training to teachers to upgrade their skills. The project was carried out in two phases whereby, phase one focused on developing Self-study in-service teachers ODeL modules for MVTTC tutors, phase one worthied 317,460,000.00 TZS. Phase two focused developing Self-study in-service teachers ODeL modules for tutors in TVET institutions which worthied 192,450,000.00 TZS. This project was favoured by the presence of ICT infrastructure present at MVTTC and NACTE (currently known as NACTVET), therefore there were no purchase of ICT equipment's throughout the project.

ShuleDirect - Since its inception, ShuleDirect has been providing cost effective e-learning platform. ShuleDirect Mobile App: Android/iOS that provides equal access to learning resources using both website and mobile application to basic secondary education from form one to form four. The aim of ShuleDirect is to serve the last mile secondary school student in the country to have access to educational content, some of the ambitions of the SIS to ensure available devices, connectivity, reliable energy and even human capacities in schools so that the system can work, makes it a formidable partner to take on this challenge together. According to ShuleDirect, it shows that 54,152 teachers, 199,102 students, and 4,700 parents are registered (see Appendix 3).

7.4. Prioritization and Sustainability of Digital Initiatives in the Country

Sustainability plan in technology integration and digital initiative in Tanzania is very crucial to be taken care in ensuring that it meets the current and future demand and achieve its longevity [29]. This also enables implementers to institutionalize and provide self-support to these initiatives. Areas to ensure digital initiatives and technology integration in education include:

- Empowering educationists, and ICT Officers with the technical and pedagogical skills who will deliver basic and tertiary education.
- Continuous awareness and clear purpose of ICT policy and curriculum and Digital learning.
- Government through Ministry / Departments / Agency should allocate funds to support future Digital initiatives without funding from donors.

7.5. The Strategic note for the Investment on Technology in Tanzania

The country has three primary options for technological advancement: first, on the basis of developing one's own technologies through ingenuity, discovery, and creativity. However, the country's ability to benefit from indigenous technologies is heavily dependent on the efficiency of a variety of innovation inputs, such as the availability of funds, a knowledgeable population, policies, and institutional arrangements: Second, by sharing technology with the source, the nation can advance technologically: The third strategy involves simultaneously developing and sharing one's own technologies. However, Tanzania has a technology deficit as a result of its inability to effectively develop indigenous technologies or transfer knowledge and technology. Despite the fact that Tanzania and the rest of Sub-Saharan Africa are technologically behind the rest, Tanzania only uses a limited transfer strategy. This is despite the fact that Tanzania's innovation inputs are so poor that they threaten the country's innovation activities and despite the fact that it is advantageous for developing nations to access and share globally available technologies.

8. Politics inn Context

A basic understanding of the following should serve as the foundation for any consideration of a useful policy:

ICT advancements have a significant impact on Tanzania's socioeconomic development. However, in order for this potential to be realized, the government will need to devote a sizeable portion of its own public policies to attracting and utilizing information technology products and services offered by innovative and globally competitive businesses. Consequently, the private sector is essential in this regard. Therefore, the government's budgetary allocations, lending policies of financial institutions, particularly venture capital and capital market institutions, international financial institutions, and non-profit communities, must develop policies and programs that effectively respond to the urgent need to establish strong private sector participation in the development of Tanzania's wider and more strategic ICT requirements. When necessary, special financial incentives must be provided in this regard. Otherwise, as it is the situation right now, "box pushers" will largely control Tanzania's ICT sector.

9. The ICT Strategic

On the aspect to digitization the process that continues to render time, space and distance can completely enhance the digitization of the curriculum in Basic Education to ensure that all students achieve lifelong learning opportunities in Tanzania. The main

goal of the proposed strategy is to provide quality inclusive equitable education and vocational skills for all basic education learners. This will be done through schools that can be used as community learning centers in each region and should include provision of buildings, renewable and self-sustaining power, IT equipment for teaching, and eLearning services. The latter can be through Government or sourcing partners and suppliers to provide materials and services so that a total solution is delivered across the country.

Innovative approach to build a modernized and integrated education solution that will help accelerate the development of quality basic education through improved infrastructure, ICT integration, career driven competence-based learning and continuous professional development with an intentional focus on equity and inclusion for learners of marginalized groups.

It is important to note that all the funding that are source out will be invested in Inclusive learning solutions as follows:

i. Digital content: Enhancing the new curriculum through digitization using a complete eLearning Ecosystem which includes a 'Software as a Service' (SaaS) solution to create, sell and deliver interactive educational content, including 'Learning Management System' (LMS) and authoring tools for teachers and students.

ii. ICT Infrastructure: Investment in devices for students, teachers, and upgrades of facilities.

iii. Rural areas: Facilities that will offer access to rural areas that have challenges with accessing ICT solutions. Equitable access to improved infrastructure, connectivity and ICT equipment in rural communities and key geographic areas of need:

- A modernized Basic Education National Centre of Digital Learning Content Development
- 25 -30 education institutions under the Pilot fully connected and equipped with ICT and
- Up to 07 Community Digital Hubs as Innovation Centers (CDHs) powered by renewable energy and including connectivity with CCTV. These will be located at TTCs, BTVET and Universities campuses connected and equipped with ICT, digitized learning content and sector-focused equipment.
- Atmospheric Water Generation Providing clean, refreshing, and sustainable drinking and domestic water is the dream of many communities around the world. This can be and has been a challenge for decades in many global regions. Tanzania has the ideal environmental climate to exploit the use of Atmospheric Water Generators (AWG). This being high humidity.

iv. Capacity building; Professional development at all

levels for teachers in Basic education, VTCs, teachers in active service especially those that major in special needs education.

On a serious note, this kind of approach with time the platform will pay for itself through subscription of the content. The Project will be self-sustaining by the end of year four (4) through revenue from accessing education platforms at a small annual subscription fee and sales of integrated hardware.

Approach

- i. The strategy will be implemented through four phases of Engage, Empower, Expand and Sustain.
- ii. This strategy addresses UN Sustainable Goals - chapter 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all).
- iii. Encompass Environmental, Sustainable and Governance (ESG) standards.

Approach Components

- i. Digital teaching and learning solution.
 - Education platform: Digital curriculum content and virtual school platform.
 - Accelerated Skills Acquisition: Workplace Integrated Learning and Agile BTVET Programming.
 - Blended (online/on site) Continuous Professional Development.
 - Connected Schools: Connectivity, Devices, Infrastructure and Solar Power.
 - Community Learning and Digital Hubs (CDH's).
- ii. Five-year pilot project highlights and implementation.
 - A modernized community Centre of Digital Content Development and Innovation.
 - Over 3,600,000 learners directly accessing the virtual education platform and content.
 - Up to 7 (seven) Community Digital Hubs (CDHs) in support of teacher training and vocational institutions fully equipped with ICT digitized learning content and equipment.
 - Creation of a Harmonized Tanzanian Sign language digital dictionary.
 - 35% increase of primary and secondary teachers trained in Competence Based curriculum, ICT use and integration as well as Inclusive Education.
 - Connectivity, over 60,950 ICT devices and power solutions to over 30 education institutions under the pilot including special needs schools.

- Assistance with professional development for 10,000 teachers, curriculum specialists, Master Teachers, and school administrators This is poised to provide a novel method of providing social services that save lives and transform communities. Every aspect will be developed in collaboration with those who will be using it. The study has created a service that will last and thrive by putting the community first and identifying and addressing their goals. Through the creation of an inclusive access to efficient education services for the 21st century, the study is obligated to ensure that the proposed method reaches the community and provides life-altering experiences.

iii. Pilot project

- Digitization of the curriculum platform creation of content and distribution.
- Fully equipped off-grid Mobile training computer labs for teacher training and student learning in the regions.
- A demonstration off-grid digital hub for community education and use at Community center.
- Smart community solahubTM infrastructure and renewable energy generation.

During this pilot phase all the bills of quantities for the entire pilot phases will be finalized and shared for approval. The final design plans and drawings will be approved and then work will commence on the critical sites that will have been selected and approved for construction. The institutions that we shall work with will contribute to the payback after the installation of the hardware and software in the schools which will contribute towards the investment.

Realizing and adhering to existing political power is a competitive advantage for achieving a predetermined strategy. The establishment of a brand-new Ministry of Communication and Information Technology, which has been given the responsibility of advancing Tanzania through the Fourth Industrial Revolution, or 4IR, also known as the Digital Economy, and increasing broadband coverage to 80% by 2025, is a striking example of positive development in Tanzania.

Interventions over the medium-term strategy that aim to achieve the anticipated effect of providing all Tanzanians with secure and affordable universal access to digital services could be one way to address the identified priority. Through specialized interventions aimed at achieving the desired outcome, this anticipated impact will be realized.

The Nationals are the most valuable strategic resource that can be discussed when it comes to ICT implementation success. Tanzania's entry, survival, and growth in the World of ICT [17], become fundamentally dependent on investments in

education, particularly in science, math, and English. This can be driven by the public or private sectors, as this new trend is just starting to emerge right now. In addition, in order to develop ICT, Tanzania must establish Centers of Excellence through meaningful Public/Private Sector Partnerships. In addition, concerns regarding; Leadership in ICT Strategy; - a more robust regulatory and legal framework; - enhancing capacity; - Recognition and growth of ICT as a crucial industry; - expansion of the ICT sector; and - Local content development could be prioritized.

9.1. Reforms Strategies

Strategy 1 - Create a global education intranet by connecting the intranets of all region's elementary and secondary schools to the Ministries of Education using the appropriate technology (cable, microwave, or a combination of the two). It is necessary to plan and organize the intranets of the nation and region in a way that makes it possible to transmit voice, video, and data at any time, seven days a week. The fact that there is no monthly connection fee for a microwave-based wireless intranet reduces ongoing costs associated with system maintenance. This study does not advocate wireless technology over any other technology; rather, it aims to highlight those advantages.

Strategy 2 - To raise funds for the ICT based modernization of school buildings, create and promote a cost-sharing cooperation framework. This framework ought to be based on matching contributions of at least equal amounts from the government, the private sector, and the school community in order to equip schools and colleges with the ICT and educational technology necessary to modernize and improve learning, teaching, and management, as well as to connect to the National Intranet. When schools apply for matching funding from the public and private sectors, their actions should be taken into consideration when they have already purchased equipment and raised money on their own. Click here to view guidelines for software and hardware donations to universities. These suggestions ought to address issues.

Strategy 3 - Communities may use the ICT resources of schools on a cost-recovery basis to access the Internet, e-mail, fax services, online courses, and for schools and colleges to provide desktop publishing and other services for the communities in which they are located. Utilizing community access and services, schools and colleges should maintain and enhance their ICT capabilities. Such a setup ought to guarantee the ICT infrastructure's long-term viability in educational institutions.

Strategy 4 - Establish in collaboration with the corporate sector and educational institutions, on a project-by-project basis for five years on a country-

by-country basis: a) Training and technical support materials for technicians working in schools or the private sector who will be in charge of maintaining the ICT systems, as well as for teachers and managers in schools and colleges who use ICT to improve management and learning. b) A certificate program on incorporating information and communications technology into the curriculum that is university moderated. Every school and institution should need at least 10% of teachers to have completed such a university-moderated certificate program by the year 2024.

At least 50% of teachers should be enrolled in courses managed by such universities by 2025. First, educators and administrators need training and technical support to transition from paper-based management systems to traditional learning and teaching methods. Schools and Universities should in her five years develop sufficient skills in the application of ICT for management and learning so that she can then assert herself. However, without training and technical support, teachers and administrators may take much longer to use her ICT properly and effectively and continue working the old way. Without proper maintenance of hardware and applications to ensure the reliability of ICT systems, a teacher and administrator cannot have confidence in his ICT infrastructure and thus achieve desired improvements and enhancements. less likely to invest significant time and talent in effecting the desired improvements and enhancements.

Strategy 5 - In areas where imported applications are inappropriate or unaffordably, encourage teachers and students to develop software, applications, and databases with the goal of enhancing, developing, and preserving Tanzania's culture and knowledge. Even though Tanzania imports and consumes ICT, the country and its regions must improve their capacity to design and manufacture information and communication products. People who are talented and driven should be encouraged to follow this path by encouraging them by giving incentive.

Strategy 6 - Empower schools, Colleges, supporting corporations and affiliations in the country to install of virtual classes, getting to know communities via utilizing the Tanzania Intranet. This can begin with incidence, specific support and need should take delivery to affiliations, businesses and regulatory bodies that as of now work utilitarian on face-to-face systems over the sub-location to include a virtual ability to their operations. On the college degree, undergraduates and teachers must be empowered and given specific acknowledgment for building up virtual communities with colleagues and peers in other international locations within the country and within East Africa zones.

Strategy 7 - Set up an evaluation system to make sure that, by 2030: All primary and secondary school

students are computer literate and able to use information and communication technologies (ICT) in their daily lives at home, in schools, for entertainment, and for communication. At the time of their admission to tertiary institutions, all students are proficient ICT users. After completing their secondary education, all students are proficient users of information and communication technology. Students who have begun to specialize in information and communication technology (ICT) are being produced by every regional school system, which is sufficient to meet the needs of the ICT industry.

10. Conclusions

From the conducted study on the mapping of digital learning and technology integration in education in Tanzania, it was noted that although there were existing and successful efforts in the country, the initiatives were disintegrated and non-harmonized.

Different partners, government and private agents, had different activities/initiatives focusing on different mission objectives ranging from capacity building, content development, connectivity, equipment distribution and policy development.

The study found that although technology is becoming more prevalent in the United Republic of Tanzania's social and economic realms, not much has been done to incorporate it into the educational system. The assertions are supported by stakeholder interviews, literature reviews, analyses of pertinent policies and activities as well as stakeholder discussions.

Information and communication technology (ICT) has been one of the main areas on which Tanzanian education systems have focused heavily. Tanzania's 2017 National Framework for Continuous Professional Development for Practicing Teachers identifies a variety of "Education Tensions" that exist at the change of the century with the goal of improving learning outcomes through the availability of competent teachers who master the subject content including pedagogical and approaches which are able to integrate technology in teaching and learning processes.

Inadequate teacher training for the development of digital skills was another obstacle to the integration of technology into education; absence of digital resources and technology at home and in schools; as well as poor power and internet connectivity in some schools areas.

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Appendices

Appendix 1. Tanzania Digital Learning Initiatives Dashboard

Digital Learning Initiative in Tanzania HOME ABOUT INITIATIVES-A INITIATIVES-B CONTACT US

Tanzania Digital Learning Initiatives Dashboard

We use data to aid decision making and collaboration among key-players in digital learning initiatives in Tanzania. After a study by UNICEF and TIE in 2022, this nationwide database of digital learning initiatives was built, to ease locating digital learning initiatives in the country. The location facility will aid both the Government and UNICEF easy reach the initiatives and provide necessary support.

Visualize the Digital Learning Initiatives in Tanzania via the map below. Click the name of the region to see the initiative (s) available in that region

Digital Learning Initiative in Tanzania HOME ABOUT INITIATIVES-A INITIATIVES-B CONTACT US

Summary of Digital Learning Initiatives in Tanzania

10	165	123
Total Digital Learning Initiatives	Primary Schools with ICT facilities	Secondary Schools with ICT facilities

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