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ACRONYMS

AI	Artificial Intelligence
BPO	Business Process Outsourcing
ILO	International Labour Organisation
ITU	International Telecommunications Union
IoT	Internet of Things
NACTE	National Council for Technical Education
NDP	National Development Plan
NICTP	The National ICT Policy SDG's Sustainable Development Goals
NTA	National Technical Awards
NVA	National Vocational Awards
RFID	Radio Frequency Identification
TCU	Tanzania Commission for Universities
TPSF	Tanzania Private Sector Foundation
TDV	The Tanzania Development Vision 2025
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VETA	Vocational Education and Training Authority
3D	Three Dimension
5G	Fifth Generation Technology

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The ICT Commission has learned and realized that every individual and organization whose business is digital centric and digitally enabled share a common vision on digital skills development. I would like to assure all stakeholders that ICT Commission will play a driving role to ensure that together we realize the vision of having a digitally skilled human capital that is competent to transform Tanzania to the Digital Economy and can confidently face the socio-economic dynamics evolving from development of digital technologies.

Furthermore, I would like to thank the Ministry of Communication and Information Technology on its day to day emphasis and policy directives towards digital skills development and its eminent policy support on developing this framework. Special thanks goes to the team comprising of *Mr. Nkundwe Mwasaga, Dr. Obeid Mahenya, Mr. Edgar Job, Eng. Jasson Ndanguzi* and *Mr. Annuary Lyimo* for their tireless efforts and collaboration to the ICT Commission in conducting the digital skills industry survey and development of this framework.

This Framework shall provide digital development stakeholders in Tanzania and individuals with guidance on digital skills training demands and enable development of occupational standards that satisfy the digital economy demands and the rising fourth industrial revolution.

Samson Mwela
Ag. Director General
ICT Commission

EXECUTIVE SUMMARY

"Digital skills development framework presents a rare opportunity to understand the complexity and dynamism of skills development in the ICT sector of Tanzania"

Information and Communication Technology (ICT) is the catalyst of national economic development and has a potential to transform the entire economy of a nation in a rapidly changing global environment. In line with that, ICT skill formation is critical to the long-term development process of any country. Nations that have embraced ICT and made it an essential aspect of their national agenda have reaped benefits in terms of social-economic development. The Government of the United Republic of Tanzania recognizes that effective use of information and knowledge is critical for rapid socio-economic growth in its aspiration to become a middle-income country by 2025.

The computerization program in Tanzania started in the 1960s. To put that in perspective, the Government of the United Republic of Tanzania acquired the first computer, an ICT 1500, installed in the Ministry of Finance in 1965. By 1974 there were seven computers in the country, and the Ministry of Finance had already acquired a new computer, an ICL 1900. ICT is growing at an alarming rate, whereby several strategic investments have been made in infrastructure and application development. The ICT sector's strategic investment enabled the creation of high-quality jobs and acts as an enabling technology for other key industries such as agriculture, finance, health, and education. With such investment, traditional economies have been transformed into digital economies. They will further be transformed by disruptive technologies such as artificial intelligence, Internet of Things (IoT), machine learning, mobile applications, Big Data Analytics, Cloud Computing Services, Blockchain Technology, Robotics, and Virtual Reality.

As a result of these transformations, there is a demand for new knowledge and skills to support countries and industries to match the new jobs that will be created from rapid technological developments. The *World Economic Forum*

estimates that 133 new million job occupations will emerge during this transformation by the year 2022 in today's dynamic and fast-changing job market.

In the past, the stakeholders in the ICT sector conducted training and skills development in the absence of a coordinated and coherent Digital Skills Development Framework. This resulted in a fragmented, uncoordinated, and haphazard approach to skills development interventions in the ICT sector. This Digital Skills Development Framework intends to address this problem. The Framework has been developed in collaboration with stakeholders from ICT sector. This indicates that skills development plans should be flexibly changing from time to time to match the ICT dependent industries skills demand. ICT skills development should be given a number one priority if countries especially developed ones, have to embrace and gain economic advantage from these technological advancements.

In terms of this framework, digital skills development refers to education, training and development activities designed to help employees(both current and future employees) gain knowledge, skills and attitudes that would improve their performance in the positions that they currently hold and improve their future prospects. Also the framework will help employers gain knowledge, skills and attitudes required by employees that would improve their performance in the positions that they currently hold and improve their future prospects. Finally, the framework will help training providers gain knowledge, skills and attitudes required to be included in the curricula that would improve competence of future employees in their performance in the occupations that they will hold and improve their future prospects.

We hope Digital Skills Development Framework to provide key information on ICT sector, career pathways, occupations/job roles, as well as existing and emerging digital skills required for the occupations/job roles.

CHAPTER ONE

BACKGROUND DIGITAL SKILLS DEVELOPMENT FRAMEWORK

1.1. Introduction

The United Republic of Tanzania is striving to implement measures of transforming its economy towards the middle-income state as stipulated in the Tanzania Development Vision 2025. The digitalization of the economy is among the Government priorities as an enabler to facilitate the attainment of the Vision's goals. The National Development Plan (NDP) for 2016/2017-2020/2021 has identified ICT as a critical enabler of socio-economic development and transformation. The plan also calls for measures to unlock the development of the ICT industry and, adoption of digital technology and innovation across critical sectors such as agriculture, health, and education.

ICT has also been identified as a key enabler towards achieving the Sustainable Development Goals (SDG's) adopted by the United Nations in 2015. ICT has enhanced economic activity efficiency in most developing countries, thus requiring them to rely on ICT skills to transform business processes and services towards the digital economy heavily. To date, digital transformation is exponentially fueled by advancement in information and communication technologies; therefore, sparking digital services demand in economic activities like manufacturing, production, governance, and other social services.

With much economic dependence on ICT for development, digital skillsets is also becoming a key economic organ for developing countries to fully participate in the digital-driven economies and benefit from the ongoing global industrial revolution. For instance, the National ICT Policy 2016 commits to creating a supportive environment for collaboration with the private sector in the development of a critical mass of ICT skills and expertise while encouraging lifelong learning through the use of ICT. Mindful of the need for the development of skills, the government has been making efforts to produce

ethical and skilled human capital to serve the nation and implement institutional reforms. In 2015, the government established the ICT Commission, which is mandated, among other activities, to develop the National Framework for ICT Skills Development. The framework provides a clear focus on the supply and demand Digital skillsets needed by Tanzania today and soon for its economic prosperity.

1.2. Rationale

Digital skills underpin nearly every aspect of work and life. From accessing Government services to business services, today it is difficult to find a job or life-task that does not require a basic digital functioning level. And with emerging technologies, we need lifelong opportunities to learn new skills that will allow us to succeed in an era of ongoing digital transformation. Unlike many traditional industries with substantial infrastructure requirements, the key resource of the ICT Sector is its people and the knowledge, skills, and competencies they possess. Hence, relatively small scale investments in developing the ICT skills of the workforce can pay rich dividends in economic returns.

Digital skills are essential in opening the door to a wide range of opportunities in the 21st century. Countries that implement comprehensive digital skills strategies ensure their populations have the skills they need to be more employable, productive, creative, and successful while ensuring they remain safe, secure, and healthy online. Critically, digital skills strategies need to be updated regularly to respond to the emergence of new technologies and their impact on the digital economy and digital society.

In line with that, the advancement of global information and communication technologies have posed a need to realign the skills needed by the employers, employees, and individuals to match the global dynamic economic and social practices dependent on ICT for their success.

Besides, the National ICT Policy (2016) recognizes the importance of ICT human capital development for accelerating ICT Industry and socio-economic

development. The policy had identified, among other challenges in the development of ICT human capital, the inadequacy of ICT skilled and competent human resources to accelerate the nation's socio-economic development efforts in the information age. In the Implementation Strategy 2016/17 – 2020/21, it has been articulated that

"The supply of ICT professionals in Tanzania is considerably less than the current demand, especially in the areas of higher skills and experience."

Furthermore, the Objective 2 of the National ICT Policy Implementation Strategy 2016/17 – 2020/21stipulate that

"*To develop and enhance human capital that is capable of championing ICT in the creation of Tanzania's knowledge-based society.*"

It is from that realization; the ICT Commission decided to develop this Digital Skills Development Framework to align individual expectations and employment aspirations of employees in the ICT industry with the ICT market goals, practices, and skills demand. A key reason for having ICT Skills Development framework is to ensure that those who do pursue ICT education or work in ICT sector do not become immobile within the education system and job market of the ICT sector. These can go on to higher education and job ladder – the first important step in moving toward lifelong learning.

1.3. Objectives

This Digital Skills Development Framework will facilitate the provision of the skills base required for the achievement of the strategic objectives of ICT Policy. Moreover, the Digital Skills Development Framework aims to facilitate, monitor and coordinate skills development activities in the ICT sector. The framework guides stakeholders, including academic institutions, technical and professional training settings, vendors, individuals, and interested parties, to adapt a collective ICT skills development effort to meet the dynamic demands of the global digital-driven economy effectively.

1.4. Methodology

Development of this framework was done through online survey and among other things, involved an assessment of the current skills supply side (training institutions) and views of the skills demand side (employers and practitioners) and capacity needs for the ICT Sector.

The survey was undertaken using questionnaire as the tool for data collection and statistical method as the means to analyse data. The questionnaires were developed to solicit information from employees and employers regarding to their perception about ICT sector skills, the digital skills gap, organization's current skills development initiatives and stakeholders' opinions regarding improvements needed to address the skills gap. The survey exercise also involved sourcing data from training authorities regarding to enrollment to ICT courses and other relevant data.

1.5. Key stakeholders involved

Development of this framework involved stakeholders from Government agencies, Educational institutions, Private sector, Civil society and Non-formal providers of digital skills training.

Specifically, more than 400 individuals in the digital solution service and application industries and, the following stakeholders participated during the survey in developing this Digital Skills Development Framework for Tanzania:

Government Ministries	
a.	*Ministry of Finance and Planning*
b.	*Ministry of Works Transport And Communication*
c.	*Ministry of Natural Resources and Tourism*
d.	*Ministry of Lands, Housing and Human Settlements Development*
e.	*Ministry of Education, Science and Technology*
f.	*Ministry of Home Affairs*
g.	*Ministry of Minerals*
h.	*Ministry of Water*

	Ministerial Departments and Agencies
a.	Business Registrations and Licensing Agency (BRELA)
b.	e-Government Authority (e-GA)
c.	Dar Rapid Transit Agency(DART)
d.	Government Procurement Services Agency (GPSA)
e.	Immigration Services Department
f.	Land Transport Regulatory Authority (LATRA)
g.	Medical Stores Department (MSD)
h.	Mining Commission
i.	National Health Insurance Fund (NHIF)
j.	National Identification Authority (NIDA)
k.	National Social Security Fund (NSSF)
l.	Tanzania Airport Authority (TAA)
m.	Tanzania Civil Aviation Authority (TCAA)
n.	Tanzania Ports Authority(TPA)
o.	Tanzania Revenue Authority (TRA)
p.	Tanzania Railways Corporation (TRC)
q.	Workers Compensation Fund (WCF)
	Banks and Financial Institution
a.	CRDB Bank PLC
b.	National Bank of Commerce (NBC) Limited
	Telecoms and ICT Companies
a.	Vodacom Tanzania PLC
b.	Business Connexion Tanzania
c.	Singo Africa Ltd
d.	Technosolutions
e.	Carvy Crafts Ltd
f.	Tujenge Technologies Ltd
g.	Homeland Technology Company Ltd
h.	Africa Internet Television Ltd
i.	ICTPACK Solutions Ltd
j.	Feasible Resources Ltd
k.	Moyo Media Company Limited

Training and Research Institutions	
a.	Dar es Salaam Institute of Technology (DIT)
b.	Mbeya University of Science and Technology (MUST)
c.	University of Dar es Salaam
d.	Tanzania Education and Research Network (TERN)

1.6. Target audience

The target groups for the Digital Skills Development Framework are as follows:

a) **Individuals** with the passion and interest to pursue a career as well as skills development in ICT, and/or who are in-service ICT professionals.

b) **Employers** of ICT professionals and Digital Specialists who would like to identify emerging skills, build new capabilities, recognize their employees' skills, invest in skills training for them, and strengthen their organizational capacity and enhance talent attraction, management, and retention.

c) **Education and Training providers** who seek to gain better insights into the skills trends in the ICT sector hence design ICT curricula that are market demand driven. They will gain insight into existing and emerging skills that are in demand.

d) **Government and Professional bodies** may wish to analyze the skills gap and design appropriate Digital Skills Development Strategies to upgrade the human resources capability and professionalize the sector.

CHAPTER TWO

POLICIES PERSPECTIVES IN RELATION TO DIGITAL SKILLS DEVELOPMENT

2.1. National Policies and Strategies related to Digital Skills

2.1.1. The Tanzania Development Vision 2025

The major aspiration of Tanzania as stipulated in its Development Vision 2025 is to transform its economy from a low productivity agricultural economy to a semi-industrialized one led by modernized technology and competent human resource.

2.1.2. The ICT Policy 2016
The National ICT Policy (NICTP) has provides a national framework for ICTs to effectively achieve national development goals and transform Tanzania into a knowledge-based society through the application of ICT.

2.1.3. National ICT Policy - Implementation Strategy 2016-2021

The policy identified the challenge of non-recognition of the ICT profession, the inadequacy of skilled and competent human resources, and illiteracy among citizens to effectively participate in a knowledge society.

2.1.4. National Education and Training Policy

The Education and Training Policy, 2014 encompasses the entire education and training sector with the objectives of increasing enrolments, enhancement of access and equity, improvement of quality and relevance, expansion and optimization of the use of facilities, and operational efficiency throughout the system.

2.1.5. The National Science and Technology Policy (1996)

The National Science and Technology Policy of 1996 attributes the framework from regulating the flow of technology and reducing excessive dependence on imported technologies and guiding the development of National Scientific and technological capability and capacity.

2.1.6. National Employment Policy, 2008

This policy articulates the need for the informal sector's improvement and transformation for creating decent jobs by empowering informal sector operators to access skills training and business development services. The policy also aspires to enhance youth employment by identifying youth-specific needs and addressing them to improve their employability and create enabling environments such as skills training, vocational guidance, and counseling. Moreover, this policy strategizes to facilitate Tanzania job seekers to acquire appropriate skills through formal and informal qualifications training programs.

2.1.7. The Technical Education Training Policy

The Technical Education Training Policy of 1996 advocates among other issues, a need for Tanzania to have sufficient trained technical manpower of all categories and the need to impart technical skills in our youths and adults to enable them to go into sustainable self-employment (social demand strategy).

2.1.8. National Skills Development Strategy (NSDS 2016 - 2026)

The National Skills Development Strategy (NSDS 2016 - 2026) emphasizes the need for a more responsive education and ongoing training to make Tanzanians competitive in the local and international markets.

2.1.9.Education and Skills for Productive Jobs Program (ESPJ)

With a timeframe of 2016-2027, ESPJ has described key sectors for skills development that would complement the Five Year Development Plan II and the 5th Government vision, of industrialization.

2.1.10.   The National Skills Development Strategy (NSDS)

Introduces a new approach to skills development in Tanzania, which is based on five principles: demand responsiveness, dynamism, results in orientation, focus, inclusiveness, and cross-sector coverage.

2.1.11.   Vocational Education Training Act

The Vocational Education Training Act of 2006 stipulates, among other things, to satisfy the demands of the labour market for employees with trade skills to improve production and productivity of the economy and promote on-the-job training in the industry for both apprenticeship training and skill updating and upgrading.

2.1.12.   National Strategy for Growth and Reduction of Poverty (NSGRP)

The strategy aims at reducing infant mortality, child mortality, malaria-related mortality, and maternal mortality. Many poor people, children, and women die without ever accessing a health facility. Equitable and sustained access to care, support, and treatment are essential to improve the well-being and life expectancy of people living with HIV and AIDS. However, issues about finances, infrastructure, human, and logistical weaknesses need to be resolved first, so as not to weaken an already constrained health system further. It is also anticipated that after graduating, graduates from this proposed program will contribute significantly to national economic growth through self-employment, in both private as well as public sectors, which require skilled personnel in ICT.

2.2. Global policy perspectives in relation to Digital skills

2.2.1. Sustainable Development Goals (SDGs) and the use of ICT

For the Sustainable Development Goals (SDGs), goal number 9 focuses on promoting infrastructure development, industrialization, and innovation. This can be accomplished through enhanced technology and innovation and increased access to information and communication technology. This goal aims to improve scientific research and upgrade the technological capabilities of industrial sectors in all countries, including developing countries. By 2030, we are encouraging innovation and substantially increasing the number of research and support domestic technology development and innovation in developing countries.

This goal can only be achieved through significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in the least developed countries by 2030. ICT Skills Development Framework is in line with this goal since it aims to produce technicians who will contribute to poverty alleviation by providing ICT solutions to the government and community through graduates.

2.2.2. UNESCO Policy on ICT in education

UNESCO helps its Member States develop and implement sector-wide policies and plans to harness the potential of ICT to ensure equitable and inclusive lifelong learning opportunities for all. For this purpose, UNESCO is developing global ICT in Education Policy Guidelines about how ICT can advance progress toward Education 2030 targets.

2.2.3. The Future of Jobs Report 2018, World Economic Forum

"Policy-makers, Regulators, and Educators will need to play a fundamental role in helping those displaced by repurposing their skills or retrain to acquire new skills. They also need to invest heavily in the development of new agile learners in future workforces by tackling improvements to education and

training systems and updating labour policy to match the realities of the Fourth Industrial Revolution".

2.2.4. Roadmap for Digital Cooperation, Report of the UN Secretary-General, June 2020

The need for digital capacity-building is substantial. Achieving real and sustained progress in the various dimensions of digitalization requires skills development and practical training, particularly in developing countries. This is necessary to unlock the benefits of technology, including the more effective use of emerging technologies and ensuring that individuals stay safe, protected, and productive online. For example, it is estimated that there will be 230 million "digital jobs" in sub-Saharan Africa by 2030 that could generate nearly $120 billion in revenue, but this would require some 650 million training opportunities by 2030.

CHAPTER THREE
DRIVERS FOR DEMAND OF DIGITAL SKILLS DEVELOPMENT

According to ITU, factors that affect the demand for digital skills include demographic trends, technological changes, business trends, trade, industry policies, and Shift to a greener economy.

The ICT industry is facing a variety of significant challenges over the coming decade. These challenges are arising because of the interaction of several significant drivers-of-change.

While it is difficult to predict the precise effect of these drivers on each of the individual sub-sectors of the ICT industry, the direction of change for the overall sector is reasonably clear. The ICT industry of the future will be characterized by greater degree of market liberation, higher levels of ICT regulation, greater intensity of competition, more consolidation across all sectors, market-led rather than production-driven, increasing sophistication of both trade buyers and consumers, higher levels of technology and, more demanding and more significant fragmentation among consumers.

These forces are likely to result in a much more demanding competitive environment and, as a result, different and higher levels of skill will be required to compete successfully.

Responding to such forces will be demanding in terms of the skills and expertise that the industry will require in the future. It is against this dynamic background that this study on the Demand and Supply of Skills in the ICT Sector has been undertaken. Therefore, the main drivers-of-change considered in this framework are Globalization and Emerging Markets, Advancement in Science and Technology like the use of Block chain technologies, Three-dimensional printing, Internet of things,5G mobile broadband, Cloud computing, Artificial intelligence and big data analytics. More drivers of change include Environmental and energy concerns, changing demographics and consumption Trends which affect life expectancy(Age) and Gender

CHAPTER FOUR

IMPACT OF ICT IN TANZANIA'S ECONOMY

The rapid spread of ICT and its pervasive penetration into all sectors of the economy has impacted the economy of Tanzania. ICT is fostering industrialization and transforming rural areas. This chapter has focused on the contribution of ICT in the Economy, Productive sectors and, ICT sector and industry development.

4.1. ICT Contribution in Economy

The government of Tanzania has introduced reforms and strategies to provide support for diverse initiatives aimed at boosting the usage of these tools in various sectors. For example, since 2003 the government has approved and implemented an ICT Policy framework, which was then subjected to amendments in 2016. The policy stipulates that ICTs are a driving force for the realization of socio-economic growth in all sectors. Among other things, the National ICT Policy 2016 intends to put in place measures and mechanisms to accelerate broadband penetration and access, strengthen ICT security and standardization, enhance management and efficient utilization of spectrum and other scarce ICT resources, promote business process outsourcing industry and improve efficiency in e-service and business.

4.2. ICT in Productive sectors

Development of any nation depends much on active and modern productive sectors, especially agriculture, tourism, natural resources (e.g., minerals, oil, and gas), energy, manufacturing, and financial services. Currently, ICT has played a significant role in supporting these productive sectors. The part that ICTs can play in improving productivity in the key productive sectors of the economy is also acknowledged in the National ICT Policy. In recognizing the role of ICT to support these sectors, the government has undertaken various efforts to ensure ICT continues to support the development of productive sectors. One of these efforts includes creating an enabling environment that facilitates the promotion of financial inclusion. Furthermore, government has invested in a national ICT Backbone, which has the potential to provide

affordable broadband to productive sectors. However, the use of ICT in the productive sector is facing such challenges as: lack of awareness of possibilities of ICT; inadequate human capital to facilitate the use of ICTs within the productive sectors; shortage of sector-specific ICT solutions tailored to local production and operational requirements; lack of linkages between productive sectors, the relatively high total cost of ownership of the ICT solutions; and general lack of an enabling and conducive environment for the uptake of ICTs in the productive sectors.

4.3. ICT Sector and Industry Development

ICT is among the fastest-growing industry in the economy and contributes significantly to socio-economic development. Research, Development, and Innovation (RDI) activities are of paramount significance for the vibrant ICT sector to cope with rapid technological changes. Furthermore, ICT can be a positive enabler of broader development objectives if implemented as a core and interrelated element. As the biggest consumers of ICT products and services, the Government wishes to capitalize on this fact to ensure that it has widespread and positive ripple effects. Finally, the ICT industry can become a source of livelihood (also from an entrepreneurial aspect), for a large section of the young population that is entering the workforce at a higher rate than what traditional sectors can employ. Most of the companies are micro and small-to-medium scale, with most of them mainly involved in distributive activities such as retailing and the distribution of computer products and services. Not much is done in the production and development of ICT products for the local and regional markets. The export industry for ICT goods and services is virtually non-existent.

In recognizing the potential of this industry, the government has taken the following initiatives to promote the ICT industry: cultivating a vibrant mobile telecommunication industry and nurturing business incubators to encourage startup companies. Despite these efforts, some challenges constrain the growth of the ICT industry and limit the realization of its full potential to contribute to the nation's development and economic growth substantially. Some of these challenges include: many local companies in the ICT sector and

industry are Small and Medium Enterprises (SME's). Most of these are mainly involved in distributive activities like retailing of imported computer products and services. Not much is done in the areas of research and development of ICT products for the local and international markets. The key challenges include: lack of incentives to attract investors to invest in ICT products locally; weak linkage between foreign direct investment (FDI) and technology transfer; and a dire need to develop an awareness of hidden and under-promoted conceptual and technical assets in intellectual property rights; inadequate support for Research, Development, and Innovation limits the growth potential of the local ICT sector and industry.

4.4. ICT in Social Sectors

There has been an improvement in adopting and using ICT in day-to-day activities. This is a result of the realization of the productive sectors' focus area of the NICTP 2003, which envisioned enabling ICT to contribute towards reducing poverty and improving the quality of life. A good example is the uptake of mobile money services. The introduction of mobile money services such as M-Pesa, Tigo Pesa, Airtel Money, and Ezy Pesa, has enabled people to save, send, and spend money, including payment of utilities' bills through mobile platforms. Besides, banks have started offering banking services through mobile platforms, which allow their customers to use mobile phones for banking transactions.

CHAPTER FIVE

CURRENT SUPPLY OF ICT SKILLS IN TANZANIA

This chapter focuses on vocational training, technical training, and higher education training in ICT. Training institutions are the key players in supplying skills and competencies to the job market in our country. Both the statistics of private and public institutions; and the highlights of performance of training providers in ICT skills development are examined. The information and analysis are derived from the data analyzed from the questionnaire administered by the ICTC and other secondary data obtained from relevant institutions.

5.1. Challenges facing the delivery of ICT Training in Tanzania

The survey undertaken toward developing this framework entailed understanding the challenges facing the delivery of ICT training under the current environment in the country. Findings and analysis of the survey responses came up with the following general observations;

a) The ICT curriculums are not timely reviewed to cope with the ever-changing nature of ICT; hence most graduates go into the job market with irrelevant skills and need further reskilling and training to become job-ready. This is bottom neck to most employers, especially SMEs who have limited resources and don't boost large capacity building budgets.

b) The low quality of new entrants to the ICT sector needs to be addressed at the school and tertiary levels. Students pursuing ICT related programmes require more training in numerical skills, literacy in soft and technical skills with adequate practical training.

c) Most training institutions lack proper modern teaching facilities and tools to deliver ICT programmes. This is partly due to the lack of resources to invest in procuring such teaching facilities and the ever-

changing nature of ICT technologies because most of this equipment is expensive and continuously upgraded.

d) The lack of cooperation between training institutions and employers or the private sector businesses in areas of enterprise-based training has played a big role in diminishing the quality of ICT programmes. Lack of formal arrangements between training institutions and employers has made securing on-job training placements extremely difficult for students and instructors.

e) Poor engagement of the demand side i.e. employers/private sector in the curriculum review/development process, has partly resulted in the existence of less relevant content offered by most ICT programs in the country. The method of reviewing or developing a curriculum should be consultative and participatory as much as possible so that the supply side, i.e., training institution, can produce graduates who meet the needs of the employers who are the demand side.

f) Lack of sufficient ICT Professionals training centers offering vendor certification thus resulting high cost of the few available ones.

5.2. Current state of Higher Education Enrolment in ICT

Higher education plays a crucial role in the production of engineers, engineering technologists, and scientists. In turn, assure a constant supply of ICT skills. The higher education band has the primary responsibility to produce the engineering and scientific skills that the ICT sector needs. There is a general agreement that there is a problem with the educational skills system. There is fragmentation in skills development and education. A positive outcome has not been achieved after decades, therefore calling for a radical change. Tables 1-5 below describe the numbers of enrollment and graduates of ICT students in higher learning institutions, technical training and vocational training institutions for the past five years.

Table 1: Students Enrolment in ICT Programmes for Five Years in higher learning institutions

S/N	Academic Year	Male	Female	Total
1.	2017/2018	4114	1994	6108
2.	2018/2019	4296	1780	6076
3.	2019/2020	4890	1874	6764

Source: **TCU**

Table 2: Students graduated in ICT Programmes for Five Years in higher learning institutions

S/N	Graduation Year	Female	Male	Total
1.	2015	158	458	616
2.	2016	324	835	1159
3.	2017	214	621	835
4.	2018	312	892	1204
5.	2019	581	1238	1819

Source: **TCU**

Technical Education Trainings

Table 3: Summary of Number of Graduates in Technical Institutions since 2014/2015 to 2018/2019

SUMMARY OF NUMBER OF GRADUATES IN TECHNICAL INSTITUTIONS SINCE 2014/2015 TO 2018/2019																
Programme: INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)																
Award Levels	2014/2015			2015/2016			2016/2017			2017/2018			2018/2019			Total
	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	
NTA 4	852	156	1008	766	246	1012	1020	361	1381	991	243	1234	943	248	1191	5826
NTA 5	677	150	827	599	139	738	514	121	635	698	201	899	712	178	890	3989
NTA 6	935	276	1211	928	232	1160	739	197	936	646	188	834	868	281	1149	5290
Sub Total	2464	582	3046	2293	617	2910	2273	679	2952	2335	632	2967	2523	707	3230	15105

Source: **NACTE**

Table 4: The enrollment of students in technical education for NTA 4, NTA 5 and NTA 6.

LEVEL	2015/16	2016/17	2017/18	2018/19
Basic Technician Certificate (NTA 4)	831	3867	2857	3208
Technician Certificate (NTA 5)	823	2198	2760	1827
Ordinary Diploma Certificate (NTA 6)	1,177	2754	2140	2132

Source: **NACTE**

VOCATIONAL TRAININGS

Table 5: Summary of Graduates in VET Centres from 2014/2015 to 2018/2019

Award Levels	2014/2015			2015/2016			2016/2017			2017/2018			2018/2019			Total
	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	M	F	Sub Total	
NVA 2	147	191	338	127	80	207	242	128	370	249	148	397	304	189	493	1805
NVA 3	11	3	14	27	7	34	32	18	50	77	16	93	24	13	37	228
Sub Total	158	194	352	154	87	241	274	146	420	326	164	490	328	202	530	2033

Source: **VETA**

Table 6: Admission to ICT Courses in VET

ADMISSION YEAR	GENDER	CERTIFICATE	DEGREE	DIPLOMA	FORM FOUR	FORM SIX	STD VII	TOTAL
2020	MALE	0	0	0	71	2	2	75
	FEMALE	0	0	0	40	0	1	41
2019	MALE	2	0	0	73	1	0	76
	FEMALE	0	0	0	20	0	1	21
2018	MALE	0	0	0	87	1	2	90
	FEMALE	1	0	0	51	0	0	52
2017	MALE	0	0	1	63	0	0	64
	FEMALE	0	0	0	19	0	1	20
2016	MALE	0	0	1	63	0	0	64
	FEMALE	0	0	0	19	0	1	20

Source: **VETA**

CHAPTER SIX

CURRENT DEMAND FOR DIGITAL SKILLS IN TANZANIA

As previously stated, the ICT Commission undertook a survey on the current state and future demands of digitals. It is from the survey that the details of skills demand to be narrated in this chapter were derived. The skills areas included both hard and soft skills.

In addition, the survey demanded this framework to elaborate and clarify the skills levels, occupational roles and category to guide employers and ICT practitioners to effectively practise their skills and have a broad understanding of the digital skills levels that they need the re-skill and up skill.

6.1. ICT Professional skills in high demand in future

ICT stakeholders have outlined ICT skills areas that will be in high demand and need for more skills development to have skilled personnel are as follows:

No.	SKILLED AREA	LEVEL OF DEMAND
1.	Artificial Intelligence	Very high
2.	Big Data analytics	Very high
3.	Cyber Security	Very high
4.	Computer Security and Cryptography	Very high
5.	Cloud Computing	Very high
6.	Block chain Technologies	Very high
7.	Computer Forensics	Very high
8.	Software Development	High
9.	Mobile Applications Development	High
10.	Robotics	High
11.	ICT Project Management	High
12.	Information Systems Audit	High
13.	Data Science	High

14.	Network Administration	High
15.	Database Administration	High
16.	Web Development	High
17.	Fiber Optic Network Design	High
18.	Data Centre Management	High
19.	Digital Arts & Animation	High
20.	Electronic System design & Repair	Low
21.	Radio Frequency Communication	Low
22.	Others	Very low

Table 7: Future skills demand for ICT Skills in Tanzania

6.2. DIGITAL SKILLS REQUIREMENTS IN ICT BY QUALIFICATION LEVELS

TABLE 8: MAPPING OF SKILLS LEVELS TO DIGITAL SKILLS REQUIREMENTS

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
Basic Skills	NVA Level 1	Certificate of Competence Level I	The holder of the qualification will be able to apply "basic craft knowledge and skills"	Basic skills cover hardware, software, and basic online operations in Artificial Intelligence, Big Data analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, Database development, Datacenter Management, Data Science,
	NVA Level 2	Certificate of Competence Level II	The holder of the qualification will be able to apply "intermediate craft knowledge and skills"	
	NVA Level 3	Certificate of Competence Level III	The holder of the qualification will be able to apply "full / higher craft knowledge and skills"	

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
	NTA Level 4	Basic Technician Certificate	The holder of the qualification will be able to apply skills and knowledge at routine level	Electronic Systems Repair and Design, Digital Arts and Animation, ICT Project Management, Fiber Optic Network design, Information Systems Audit, Mobile Applications Development, Network Administration, Radio Frequency Communication, Robotics, Software Development, and Web development.

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
Intermediate Skills	NTA Level 5	Technician Certificate	The holder of the qualification will be able to apply skills and knowledge in a range of activities, some of which are non-routine and be able to assume operational responsibilities.	Intermediate skills enable us to use digital technologies in even more meaningful and beneficial ways, including the ability to critically evaluate technology or create

	NTA Level 6	Ordinary Diploma	The holder of the qualification will be able to apply skills and knowledge in a broad range of work activities, most of which are non-routine.	content. These encompass those skills needed to perform work-related functions in Artificial Intelligence, Big Data analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, Database development, Datacenter Management, Data Science, Electronic Systems Repair and Design, Digital Arts and Animation, ICT Project Management, Fiber Optic Network design, Information Systems Audit, Mobile Applications Development, Network Administration,

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
				Radio Frequency Communication, Robotics, Software Development, and Web development.
	NTA Level 7	Higher Diploma	The holder of the qualification will be able to apply knowledge, skills and understanding in a broad range of complex technical activities, a high degree of personal responsibility and some responsibility for work of others	

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
Advanced Skills	NTA Level 8	Bachelor's degree	The holder of the qualification will be able to apply knowledge, skills and understanding in a wide and unpredictable variety of contexts with substantial personal responsibility, responsibility for the work of others and responsibility for the allocation of resources, policy, planning, execution and evaluation.	Advanced skills are those needed by specialists in ICT professions such as Artificial Intelligence, Big Data analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, Database development, Datacenter Management, Data Science, Electronic Systems Repair and Design, Digital Arts and Animation, ICT Project Management, Fiber Optic Network design, Information Systems Audit, Mobile Applications Development, Network Administration, Radio Frequency Communication, Robotics, Software Development, and Web development.
	NTA Level 9	Master's degree	The holder of the qualification will be able to display mastery of a complex and specialised area of knowledge and skills, employing knowledge and understanding to conduct research or advanced technical or professional activity, able to work autonomously and in complex and unpredictable situations	

Skills Level	Qualification Level	Qualification Award	Competence Level Descriptors	Skills Requirements
	NTA Level 10	Doctorate Degree	The holder of the qualification will be able to apply knowledge and understanding and do advanced research resulting into significant and original contributions to a specialised field, demonstrate a command of methodological issues and engaging in critical dialogue with peers, able to work autonomously and in complex and unpredictable situations.	

Source: Framework of Technical and Vocational Education Training (TVET) Qualifications

CHAPTER SEVEN

DIGITAL SKILLS AND OCCUPATIONAL FRAMEWORK

In recognition of changes in work conditions and labour markets brought by digital technoloies, we adopted a self-sustaining skills ecosystem based on Finegold (1999) as the framework to understand the conditions and context of digital skills demand, supply, deployment, and development within our digital economy. Based on Buchanan (2017), the framework we adopted stipulates four interdependencies that are mutually reinforcing dynamics that are ever generating ongoing knowledge adaptation, growth, and creation to changing labour market and work conditions. In the context of the digital economy, we describe the digital skills ecosystem of Tanzania to take account of the complexity created by economic, educational, and political contexts that can impact digital skills in terms of:

- development,
- supply,
- demand, and
- deployment.

7.1. Digital Skills Deployment

In addressing the skill base for a digital economy using the framework, we define Deployment as to how digital skills are effectively practiced and utilized within the context. According to Anderson (2012), the Ecosystem benefit when the expertise, skills, and knowledge of the workforce are utilized well. The utilization of the skills can be about changing occupation (job roles and structure) to facilitate demand for multi-skilling in the digital economy.

According to the study conducted by ICT Commission with regards to Tanzania Digital Skills Development and Occupational Framework, the results showed

that, amongst employers, almost 87.7% of the respondents indicated that during the recruitment process the preference is given towards university degree graduates, 48.4% towards those with professional vendor-specific certificates, 46.3% with Diploma & Technical certificates and 19.5% with Vocational certificates as shown in figure 1 below;
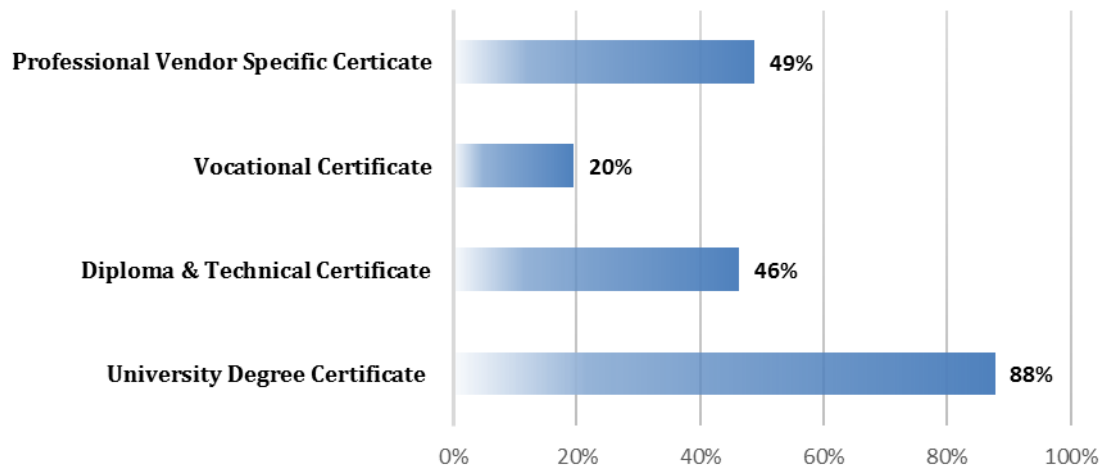
Figure 1: The preference of employers towards various ICT certificates

The results prove the utilization of expertise, skills, and knowledge of the workforce employed in the digital skills ecosystem.

7.2. Digital Skills Demand

Demand concerns with recognizing what current digital skills are needed in the ecosystem and what in the future may be needed to address the changing context brought by digital economy. Oftentimes as stated by Finegold (1999), recruitment measures are recognized not to meet the skills demand of the ecosystem. In the case of the digital economy, the missing skills can be specialized, transferable, and generic in order to fulfill the demands of 4IR.

According to the study conducted by ICT Commission with regards to Tanzania Digital Skills Development and Occupational Framework, the study found the current demands of digital specializations or skills that are difficult to be filled by employers are Cybersecurity, Artificial Intelligence, Big Data analytics,

Computer Forensics, Computer Security and Cryptography, Cloud Computing, Blockchain Technology, Robotics, Software Development, and ICT Project Management as shown below:
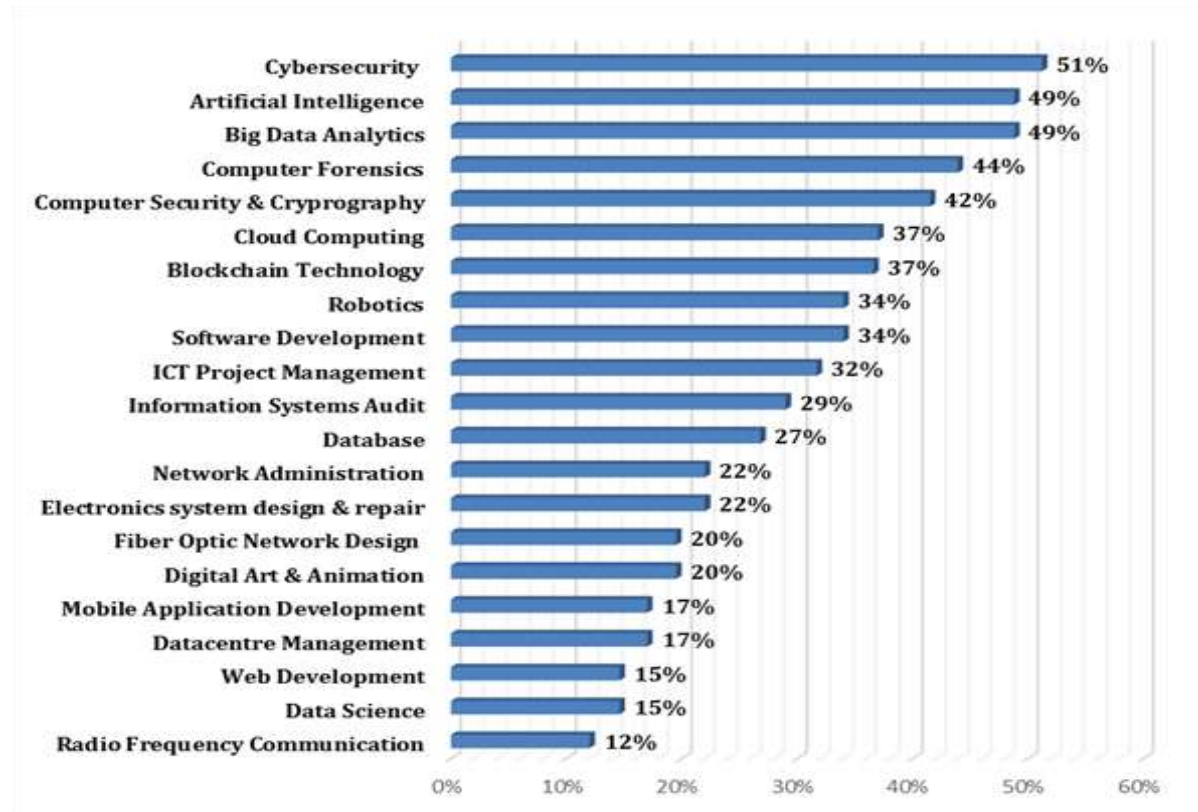
The results of the figure above are consistent with the results of employees, where the majority indicated that the skills gap are in Artificial Intelligence, Big Data Analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cybersecurity, ICT Project Management, and Robotics.

Furthermore, when employers were asked about the future demand in digital specializations or skills, the study found, among others, the demand to be in Artificial Intelligence, Big Data analytics, Cybersecurity, Computer Security and Cryptography, Cloud Computing, Blockchain Technology, Computer Forensics, Software Development, Mobile Application Development, Robotics, and ICT Project Management.
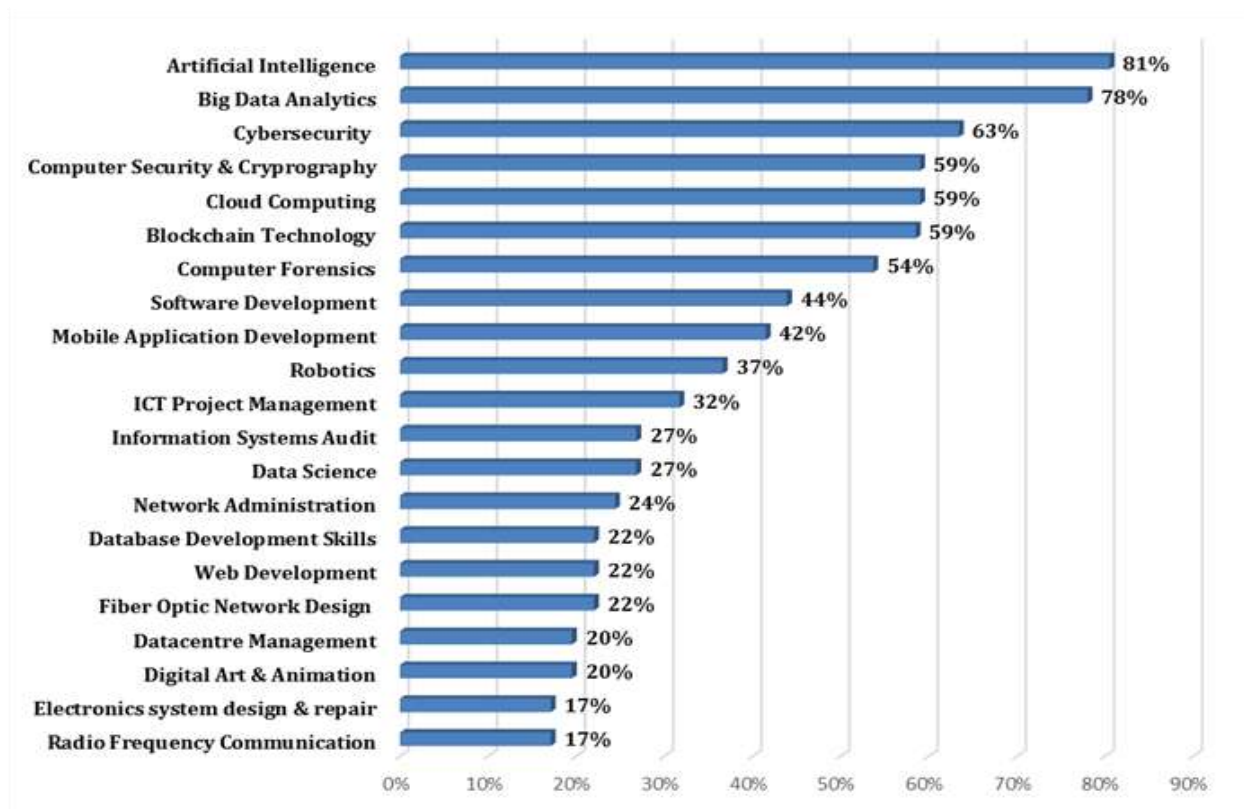
The results of the figure above are consistent with the results of employees where the majority indicated that the future digital specializations or skills demand are in Artificial Intelligence, Big Data Analytics, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, and Robotics.

Evidently, the current and future demands of digital specializations or skills as indicated by employees and employers are in line with the demands in digital skills brought by the digitally-enabled economy.

7.3. Digital Skills Supply

Supply concerns about how the ecosystem is nourished by the constant flow of skills, as indicated by Finegold (1999). Supply is about recruitment, strategies that focus on retention, and career development pathways. In recruitment measures, the emphasis is on extending expertise, skills, and knowledge through the new staff. The incentive of an attractive salary is normally used to attract those with the demanded qualification, skills, knowledge, and expertise.

In 2019, the total number of graduates from the supply-side of our digital skills ecosystem with demanded qualification, skills, knowledge, and expertise in ICT from the vocational system were 530, the technical system for all levels were 3230, and the university system were 1819. These are encouraging numbers. However, according to IMF, sub-Saharan Africa has been able to add to the job market, an average of 9 million jobs per year since 2000. Most of these jobs are in the private sector (self-employed) and in sectors with low productivity, such as low-value-added services and agriculture. Hence the adoption of digital technologies in the private sector to improve their productivity will create a demand for digital skills required in the digital economy. Therefore the supply side should keep pace with the demand for digital skills required in the digital economy.

According to the study of Tanzania Digital Skills Development and Occupational Framework, the attributes that employers value more from ICT graduates clearly shows the majority of employers prefer both hard skills and soft skills. Even though almost two-thirds of the employers prefer hard skills, hence possession of these skills will increase the probability of employees to be retained and for the employers to consider career development pathways.

The majority of employees indicated the skills gap from most ICT professionals in the ICT Industry to be technical know-how skills in ICT, general ICT user skills, written communication skills, managerial skills, and oral communication skills. The technical know-how skills in ICT have scored the highest, followed by managerial skills.

7.4. Digital Skills Development

Development focuses on how expertise, skills, and competencies are nurtured within a context and go beyond training interventions. Formal learning, in-house training, on-the-job training, and informal learning can constitute skills development. In the digital economy, the workforce should be supported and

encouraged in their use of technology so that digital skills can be developed, as indicated by Windsor (2008).

According to the study of Tanzania Digital Skills Development and Occupational Framework, the results showed that 81% of the employer indicated that the ICT professional employees meet the minimum job requirements needed to perform their daily tasks, but due to the undoubtedly dynamic nature of the ICT sector, 90% of the employers indicated that they need to provide on-job ICT professional training to their staff in order to keep them up to date with the current ICT trends.
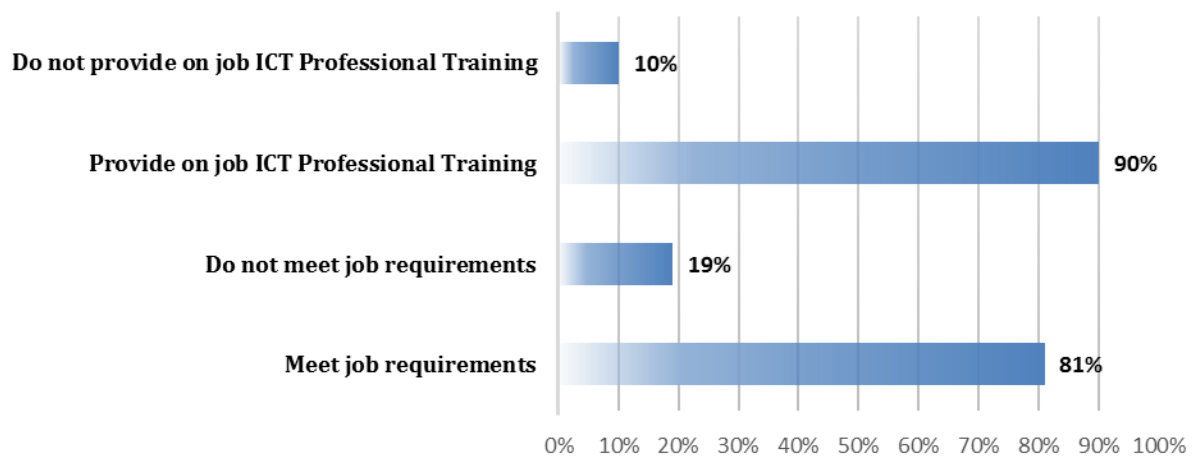
Figure 5: Percentage of ICT employees meeting job requirements and organizations providing on-job ICT Professional training

However, despite the efforts of the majority of the employer to upskill and reskills their ICT Professions, the majority of the employer respondent indicated that they encounter a number of challenges in conducting/providing such training, citing the high costs/fees associated with the ICT professional trainings as the major challenge, an insufficient number of training centres where most courses been offered are irrelevant and delivered by incompetent trainers respectively.

Also, the majority of the employees, when asked about on-job ICT training, indicated that the on-job ICT training measure focused on reskilling and up-

skilling. However, the majority of employees indicated that ICT training exclusively focuses on reskilling. This is consistent with the measure required by demands in digital skills brought by the digitally-enabled economy.

According to ILO, contemporary issues of labour market supply and demand in occupations associated with ICT have been major concerns in government and in the private sector at both national and international levels. In Tanzania as elsewhere, often policy debate about ICT occupations have not been well defined in the Tanzanian context. The ICT occupational structure of the ICT labour market not as well clearly defined. This has been partly contributed by the absence of an appropriate framework and agreed terminology for describing and quantifying ICT occupations.

The update of the International Standard Classification of Occupations (ISCO) offers a timely opportunity to address the challenge of the ICT occupational structure of the ICT labour market. It therefore important for Tanzania to describe digital skills categories which are aligned to the National Skills Qualification Framework to adequately inform the skills supply side on the expected outcomes that an individual is expected to provide during his/her practice in the industry. The table below narrates twelve (12) skills categories and their related skills level required by the business industry. This will assist to inform training institutions to develop ICT curriculums of a specific skills category based on the industry demand.

No.	SKILL CATEGORY	SKILLS TITLE	NVA 1	NVA 2	NVA 3	NTA 4	NTA 5	NTA 6	NTA 7	NTA 8	NTA 9	NTA 10
1.	Business and Project Management	Agile Coaching								X	X	X
		Business Agility								X	X	X
		Business Continuity							X	X	X	X
		Business Environment Analysis								X	X	X
		Business Innovation								X	X	X
		Business Needs Analysis							X	X	X	X
		Business Process Re-engineering								X	X	X
		Business Requirements Mapping								X	X	X
		Business Risk Management								X	X	X
		Change Management								X	X	X
		Crisis Management								X	X	X
		Demand Analysis							X	X	X	X
		Disaster Recovery Management								X	X	X

No.	Category	Skill										
		Emerging Technology Synthesis								■	■	■
		Manpower Planning								■	■	■
		Portfolio Management								■	■	■
		Process Improvement and Optimisation								■	■	■
		Product Management								■	■	■
		Project Feasibility Assessment								■	■	■
		Project Management								■	■	■
		Strategy Planning								■	■	■
		Sustainability Management								■	■	■
2.	Business Development	Business Negotiation									■	■
		Data Analytics								■	■	■
		Networking	■	■	■	■	■	■	■	■	■	■
3.	Finance	Budgeting							■	■	■	■
		Financial Management	■	■	■	■	■	■	■	■	■	■

No.	Category	Item										
4.	Design and Architecture	Data Design									▦	▦	▦
		Design Thinking Practice			▦	▦	▦	▦	▦	▦	▦	▦
		Embedded Systems Integration			▦	▦	▦	▦	▦	▦	▦	▦
		Embedded Systems Interface Design					▦	▦	▦	▦	▦	▦
		Enterprise Architecture			▦	▦	▦	▦	▦	▦	▦	▦
		Infrastructure Design								▦	▦	▦
		Organisational Design								▦	▦	▦
		Security Architecture			▦	▦	▦	▦	▦	▦	▦	▦
		Software Design								▦	▦	▦
		Solution Architecture			▦	▦	▦	▦	▦	▦	▦	▦
		Systems Design						▦	▦	▦	▦	▦
		User Experience Design			▦	▦	▦	▦	▦	▦	▦	▦
		User Interface Design			▦	▦	▦	▦	▦	▦	▦	▦
5.	Development and	Agile Software Development			▩	▩	▩	▩	▩	▩	▩	▩

	Implementation	Applications Development										
		Applications Integration										
		Cloud Computing										
		Computational Modelling										
		Computer Vision Technology										
		Configuration Tracking										
		Continuous Integration and Continuous Deployment										
		Control System Programming										
		Data Engineering										
		Data Visualisation										
		Embedded Systems Programming										
		Failure Analysis										
		Infrastructure Deployment										

			Capability									
			Intelligent Reasoning			▓	▓	▓	▓	▓	▓	▓
			Network Configuration	▓	▓	▓	▓	▓	▓	▓	▓	▓
			Network Security			▓	▓	▓	▓	▓	▓	▓
			Network Slicing	▓	▓	▓	▓	▓	▓	▓	▓	▓
			Pattern Recognition Systems								▓	▓
			Process Validation								▓	▓
			Quality Assurance			▓	▓	▓	▓	▓	▓	▓
			Quality Engineering			▓	▓	▓	▓	▓	▓	▓
			Radio Frequency Engineering			▓	▓	▓	▓	▓	▓	▓
			Research						▓	▓	▓	▓
			Security Assessment and Testing							▓	▓	▓
			Security Programme Management			▓	▓	▓	▓	▓	▓	▓
			Self-Learning Systems			▓	▓	▓	▓	▓	▓	▓
			Software Configuration			▓	▓	▓	▓	▓	▓	▓

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No.	Category	Capability										
		Software Testing			■	■	■	■	■	■	■	■
		System Integration			■	■	■	■	■	■	■	■
		Test Planning			■	■	■	■	■	■	■	■
		Text Analytics and Processing							■	■	■	■
		User Testing and Usability Testing			■	■	■	■	■	■	■	■
6.	General Management	Business Performance Management							■	■	■	■
		Vendor Management							■	■	■	■
7.	Governance and Compliance	Audit and Compliance								■	■	■
		Cyber Risk Management								■	■	■
		Data Ethics								■	■	■
		Data Governance								■	■	■
		Data Protection Management								■	■	■
		Data Sharing								■	■	■
		IT Governance								■	■	■

#													
		IT Standards											
		Quality Standards											
		Security Governance											
8.	Operations and User Support	Applications Support and Enhancement											
		Cyber and Data Breach Incident Management											
		Cyber Forensics											
		Data Centre Facilities Management											
		Data Migration											
		Database Administration											
		Infrastructure Support											
		IT Asset Management											
		Network Administration and Maintenance											
		Performance Management											

No.	Category	Subcategory	1	2	3	4	5	6	7	8	9	10
		Problem Management							▓	▓	▓	▓
		Security Administration			▓	▓	▓	▓	▓	▓	▓	▓
		Security Education and Awareness						▓	▓	▓	▓	▓
		Threat Analysis and Defence						▓	▓	▓	▓	▓
		Threat Intelligence and Detection						▓	▓	▓	▓	▓
9.	People Development	Learning and Development								▓	▓	▓
		People and Performance Management								▓	▓	▓
10.	Sales and Marketing	Account Management							▓	▓	▓	▓
		Brand Management							▓	▓	▓	▓
		Business Development							▓	▓	▓	▓
		Consumer Intelligence Analysis							▓	▓	▓	▓
		Content Management			▓	▓	▓	▓	▓	▓	▓	▓
		Content Strategy							▓	▓	▓	▓

		Customer Behaviour Analysis										
		Customer Experience Management										
		Design Concepts Generation										
		Integrated Marketing										
		Market Research										
		Market Trend Analysis										
		Marketing Campaign Management										
		Marketing Communications Plan Development										
		Marketing Mix Management										
		Marketing Strategy										
		Media Platforms Management										
		Media Strategy Development										
		Pricing Strategy										

#	Category	Subcategory										
		Sales Channel Management							grey	grey	grey	grey
		Sales Strategy							grey	grey	grey	grey
		Technical Sales Support		grey	grey	grey	grey	grey	grey	grey	grey	grey
11.	Stakeholder and Contract Management	Contract Management							yellow	yellow	yellow	yellow
		Partnership Management							yellow	yellow	yellow	yellow
		Procurement							yellow	yellow	yellow	yellow
		Service Level Management		yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow	yellow
		Stakeholder Management							yellow	yellow	yellow	yellow
12.	Strategy Planning and Implementation	Data Strategy									navy	navy
		Infrastructure Strategy					navy	navy	navy	navy	navy	navy
		IT Strategy									navy	navy
		Organisational Analysis									navy	navy
		Security Strategy									navy	navy
		Strategy Implementation					navy	navy	navy	navy	navy	navy

CHAPTER NINE

CONCLUSION AND RECOMMENDATION

In responding to the rapid changes of technology in global digital economy, the framework presents the plan for digital skills development in response to the requirements of our digital economy. The framework articulated the need for regular skills-retraining and reskilling for employees in order to keep up with the pace of technological changes in Artificial Intelligence, Big Data analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, Database development, Datacenter Management, Data Science, Electronic Systems Repair and Design, Digital Arts and Animation, ICT Project Management, Fiber Optic Network design, Information Systems Audit, Mobile Applications Development, Network Administration, Radio Frequency Communication, Robotics, Software Development, and Web development.

The skills gaps indicated by employees are in Artificial Intelligence, Big Data analytics, Blockchain Technology, Cloud Computing, Computer Forensics, Computer Security and Cryptography, Cyber security, ICT Project Management, and Robotics.

ICT Commission expecting that digital skills development framework will aide to the development, supply, fulfil the demand, and deployment of necessary digitally skilled workforce for rapid socio-economic development of Tanzania