



Competing in a Digital Age

**The Development
of IT Skills & Jobs
in Kenya and
Uganda**



Final Report

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A report by Youth Impact Labs

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LIST OF ACRONYMS AND ABBREVIATIONS

4IR	Fourth Industrial Revolution
AES	Advanced Encryption Standard
AfDB	African Development Bank
AI	Artificial Intelligence
ALU	African Leadership University
AMQP	Advanced Message Queuing Protocol
ARM	Advanced RISC Machines
ASIC	Application-Specific Integrated Circuit
BIST	Bachelor of Information Systems and Technology
BLE	Bluetooth Low Energy
BLS	United States Bureau of Labour Statistics
BPO	Business Process Outsourcing
BUBU	Buy Uganda Build Uganda
CAGR	Compound annual growth rate
CoAP	Constrained Application Protocol
CSS	Cascading Style Sheets
CTO	Chief Technology Officer
CV	Curriculum Vitae
DTLS	Datagram Transport Layer Security
DTLS	Datagram Transport Layer Security
EdTech	Education Technology
EU	European Union
Fintech	Financial Technology
FMCG	Fast-moving Consumer Goods
FPGA	Field-Programmable Gate Array
GDP	Gross Domestic Product

GDPR	General Data Protection Regulations
GOK	Government of Kenya
GOU	Government of Uganda
GPIO	General Purpose Input/Output
HEI	Higher Education Institution
HR	Human Resource
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hyper Text Transfer Protocol Secure sockets
HW/SW	Hardware-Software
I2C	Inter-Integrated Circuit
IBSAT	International Business, Science & Technology
ICT	Information and Communications Technology
IDC	International Data Corporation
IFC	International Finance Corporation
IOS	Input/Output System
IoT	Internet of Things
IT	Information Technology
ITC	International Trade Centre
ITES	Information Technology Enabled Services
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KCPE	Kenya Certificate of Primary Education
KCSE	Kenya Certificate of Secondary Education
KICTB	Kenya ICT Board
KNEC	Kenya National Examinations Council
MICT	Ministry of Information, Communications and Technology
MNC	Multinational Company
MOOC	Massive Open Online Course
MQTT	Message Queuing Telemetry Transport

NGO	Non-governmental Organization
OECD	Organisation for Economic Co-operation and Development
OSCP	Offensive Security Certified Professional
PHD	Doctor of Philosophy
PHP	PHP: Hypertext Preprocessor
RSA	Rivest, Shamir, and Adelman
SAP	Systems, Applications and Products
SAS	Serial-Attached SCSI (Small Computer System Interface)
SME	Small and Medium-sized Enterprises
SoC	System On a Chip
SQL	Structured Query Language
SSL	Secure Sockets Layer
Tech	Technology
TLS	Transport Layer Security
UGX	Ugandan Shilling
UI	User Interface
UK	United Kingdom
UNCDF	United Nations Capital Development Fund
US	United States of America
USB	Universal Serial Bus
USD	United States Dollar
USIU	United States International University
USSD	Unstructured Supplementary Service Data
UX	User Experience
VPN	Virtual Private Network
WEF	World Economic Forum



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About Youth Impact Labs

Catalyzed by funding from Google.org, Mercy Corps' Youth Impact Labs (YIL) identifies and tests creative, technology-enabled solutions to tackle global youth unemployment, accelerating job creation to enable every young person to access opportunities for dignified, purposeful work. Focusing on vulnerable youth aged 15 – 35, Youth Impact Labs operates in two strategic regional hubs, serving the Middle East and East Africa. In Kenya, YIL focuses on digital market-places and platforms that offer services to micro and small enterprises; agricultural supply chain management; and digital work. The programme supports these enterprises through financial and technical support, issued in the form of milestone-based grants.



About Moringa School

Moringa School is a Nairobi, Kenya-based multi-disciplinary workforce development platform committed to providing young Africans with the technical and soft skills they need to excel in their careers. Through experienced teachers and mentors, a blended learning model, and a market and outcomes-driven curriculum, Moringa School's mission is to transform higher education throughout Africa and enable its graduates to be globally competitive with their peers. With locations in Kenya, Uganda and Rwanda, the school has placed more than 90% of its graduates into leading companies across Africa and the world. Moringa School was named one of the 'Top 10 Most Innovative Companies' in 2018 by Fast Company.

EXECUTIVE SUMMARY

The Fourth Industrial Revolution (4IR) is disrupting business models across sectors and industries, thus creating profound changes in the employment landscape around the world: the reconfiguration of global value chains will lead to an increasingly ambiguous dynamic in terms of where products are made, where value is generated, and who ultimately benefits. Both to avoid being left behind by the 4IR and to take advantage of the opportunities which it will create, it is critical that developing economies, such as Kenya and Uganda plan accordingly, bearing in mind the particularities of their own industries. While global trends will impact both countries, the extent to which this will occur and the timeframe are likely to differ. By the same token, trends that may be unusual in the global context, e.g. USSD development, will continue to be relevant for some time to come.

This signals the need for digital skills development that is contextually relevant, especially within advanced IT; “tens of millions of jobs” are expected to arise in coming years for people with advanced digital skills, with some economies predicting a talent gap for workers with advanced digital skills and others ranking ICT specialists among their fastest-growing roles (Digital Skills Preparing Youth for the Future of Work in the Digital Economy). The importance of accessing these new jobs is compounded by the well-documented growth of and joblessness within Africa’s youth population.

However, at present a skills gap within advanced IT pervades in Kenya and Uganda, and with university curricula failing to reflect the rapidly developing demands of the IT industry, this is set to widen. Informal programs and specialist IT schools are attempting to fill this shortcoming in advanced IT skills training and provision.

In this context, this paper explores the sources, nature, and size of this skills gap in Kenya and Uganda by examining existing IT skills among respective workforces, and comparing them to the skills currently and likely to be demanded by local and international employers. This is based on over 40 in-depth interviews with employers, educators, and IT professionals; an online survey responded to by 47 entrepreneurs and IT professionals; market forecasting; and supporting desk-based research. The research and analysis focus in particular on Nairobi and Kampala as the respective commercial centres of each country.

It is intended that the findings of this report should:

- › Help IT professionals understand the skills and jobs that are in demand today and are likely to come into demand in the medium- to long-term.
- › Help employers – both within and outside the IT industry – understand and appreciate the role that advanced IT and IT professionals are playing and can play in their businesses.
- › Highlight the ongoing disconnect between higher education institutions and the private sector.
- › Help both universities and specialist IT schools gauge and respond to the skills gap which exists within the IT industry.

Key Insights: Kenya

- › Though digital jobs have the potential to create significant employment opportunities in Kenya, there is a shortage of IT professionals, which is expected to grow.
- › The IT skills gap is stark; deficiencies in the current formal education system are the major contributing factor, since most universities fail to keep up with evolving skill demand. All stakeholders agreed that public universities in Kenya do not provide the right skills to match market needs.
- › Tech hubs, an array of specialist training institutions, online platforms, and a small number of universities (most notably Strathmore) are attempting to address this skills gap. Several IT professionals - and 40% of our survey respondents- resort to teaching themselves.
- › Interviews suggest that many employers still do not fully understand what IT entails, and by extension, businesses often do not know who to hire, the skills needed, and how to deploy them effectively.
- › Analysis of advertised jobs reveals developers to be in highest demand, accounting for more than half of all job postings; this trend was confirmed in interviews. More than 50% of postings seek mid-level applicants with 2-5 years' experience; only 2% seek entry-level candidates.
- › In Kenya, the ICT sector is expected to contribute 1.37% to GDP by 2022. This will place the value of the ICT industry at US\$1.7 billion in 2022.
- › We estimate that the Higher Education for Technology market will be valued at US\$51.54m by 2022, assuming the growth rate remains constant.
- › We project that the number of IT professionals in employment will grow to 95,000 by the end of 2022 from 57,000 in 2017, driven by increased investment in IT services by companies and demand for high-end IT skill sets such as project management, data science, and software engineering.
- › In 2022, we forecast that 17,671 higher education students will graduate with IT qualifications in Kenya.



Key Insights: Uganda

- › While statistics on job figures within the IT sector are not readily available, discussions with employers suggest that demand for competent IT professionals far outweighs supply.
- › Universities do not offer IT skills that match market demand, with many Ugandans taking online IT courses offered by international training and certification providers to increase their chances of employment.
- › There are several specialist commercial IT providers and incubation hubs based in Kampala that are upskilling Ugandans to bridge the widening skills gap.
- › Ugandan IT graduates not only lack hard skills, but also the soft skills needed to be ready for deployment into the workforce. Without exception, this shortcoming was mentioned as a major problem by employers interviewed.
- › Almost half of IT-related job postings were for administrative IT roles. Just 13% were for developers.
- › In contrast to Kenya, the current Ugandan policy and regulatory environment is deterring investment, which impedes the growth of the IT industry.
- › The ICT sector is expected to contribute 2.83% to GDP by 2022. This will place the ICT industry value at US\$1.13 billion by 2022.
- › The contribution of Higher Education to GDP is much lower in Uganda than Kenya, 0.2% compared to 1%. Despite this, the market was valued at US\$2.02m in 2017, and assuming a constant growth rate, is expected to be valued at US\$3.07m in 2022.
- › We forecast that the number of IT professionals in employment will grow to 43,400 employees by the end of 2022 from 28,500 in 2017.
- › In 2022, we estimate that 3,222 students will graduate with IT qualifications.



Overall Recommendations

- › In order to keep pace with the 4IR, there needs to be a paradigm shift in training and skills development, particularly within universities, both in Kenya and Uganda.
- › Steps should be taken to address the disconnect between IT education providers and employers, with curricula adapted to reflect the needs of the IT industry more closely. This should recognise the differences in demand between larger firms/corporations and SMEs/start-ups.
- › Both universities and specialist IT training institutes should pay attention not only to emerging technologies and trends, but also the specific skills they require
- › Extensive practical application of theoretical concepts needs to be introduced into curricula.
- › Educational providers should also consider marrying technical and soft skills more closely. Employers highlighted repeatedly how the deficiency in soft skills limited their ability to provide effective service to clients.
- › The lack of understanding of advanced IT among the private sector in general suggests a need for sensitization of businesses, whether through peer-to-peer instruction or greater communication between the private sector and training institutions.
- › The Government of Uganda should look to the Government of Kenya's more progressive policies on the ICT sector for guidance on future strategy; Uganda's existing plans do not give enough consideration to advanced IT skills, while restrictions on mobile messaging and money are detrimental to growth of the IT sector.

INTRODUCTION

The Fourth Industrial Revolution (4IR) is disrupting business models across sectors and industries, thus creating profound changes in the employment landscape around the world. Technological disruptors are significant drivers of the 4IR with mobile internet and cloud technology as the frontrunners. Other technological drivers of the 4IR include: processing power and big data, new energy supplies and technologies, internet of things (IoT), sharing economy and crowdsourcing, robotics and autonomous transport, artificial intelligence, advanced manufacturing and 3D printing, and advanced materials and biotechnology (WEF, The Future of Jobs).

New digital technologies are not only disrupting sectors and industries, but also changing the location and organisation of activities within global value chains. The advent of IoT, for example, has reduced the transaction costs associated with international production and facilitated a deepening international division of labour in the global value chain. On the other hand, industrial robotic systems are likely to impact the location of manufacturing activities and redirect many activities from emerging economies (whose labour and production costs are increasing) back to advanced economies, even as the opportunity for “remote work” allows people in developing economies to benefit from new roles and positions in advanced economies. The “inevitable reconfiguration” of global value chains will lead to an increasingly ambiguous dynamic in terms of where products are made, where value is generated, and who ultimately benefits (Industry 4.0, Global Value Chains & Intl. Business).

A systematic movement towards a digital economy is, therefore, fundamental for developing economies to ensure that they are not left behind by the 4IR, which is likely to reorient global value chains in significant ways.





A move towards a digital economy requires a wide range of digital skills. The real long-term benefits of digital jobs are not in the delivery of digital products or services but, rather, in their creation, i.e. in “digital design, creation and engineering” (Can Digital Jobs Solve Africa’s Unemployment Crisis?). The skills needed to achieve these benefits can be classified into basic, mid-level and advanced digital skills, as follows:


Table 1: Digital Skills

Basic digital skills	Mid-level digital skills	Advanced digital skills
<ul style="list-style-type: none"> Web research Online communication Use of professional online platforms Use of digital financial services 	<ul style="list-style-type: none"> Digital graphic design and marketing Desktop publishing and social media management both for job and entrepreneurship opportunities 	<ul style="list-style-type: none"> Technology development Network management Machine learning Big data analysis IoT Cyber security Blockchain technology


“Tens of millions of jobs” are expected to arise in coming years for people with advanced digital skills, with some economies predicting a talent gap for workers with advanced digital skills and others ranking ICT specialists among their fastest-growing roles. In China, 7.5 million out of 18 million information technology roles could go unfilled by 2020, while the EU predicts a high-tech skills demand to the tune of 9,174,000 by 2020.

The United States Bureau of Labour Statistics (BLS) forecasts 3,475,000 computer and information technology job openings between 2016 and 2026, and further estimates that these jobs will grow by 13% during this time (Digital Skills Preparing Youth for the Future of Work in the Digital Economy). In OECD economies, currently, 1 in 10 jobs are at risk of automation by 2024, while roles requiring digital skills will grow by 12% (New Skills Now).


7.5 Million of 18 Million
China's Information technology
jobs could go unfilled by 2020



EU predicts a tune of
9,174,000
high-tech skill demand by 2020

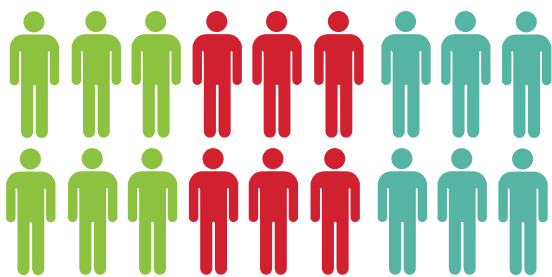


BLS forecasts **3,475,000**
computer and information technology
job openings between 2016 and 2026



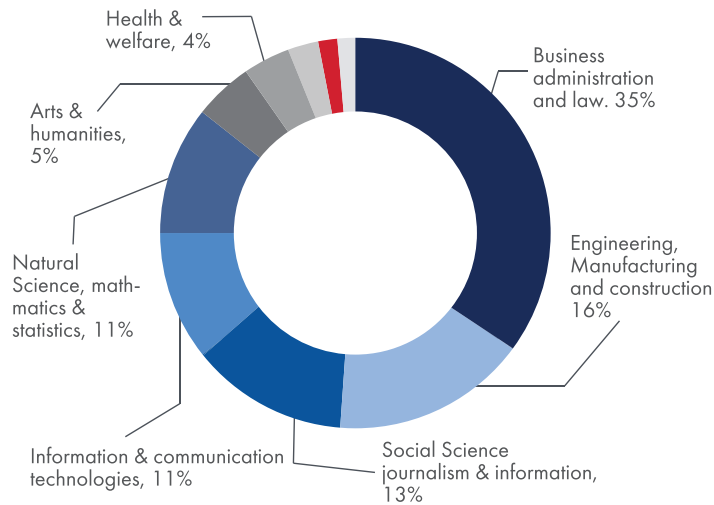
As opposed to developed countries, where automation and other emerging technologies are set to significantly disrupt industries on a shorter time horizon, Africa has a longer window of opportunity with the risk of automation mitigated by relatively lower labour costs and the creation of new jobs (The Future of Jobs and Skills in Africa). As the world transforms into a digital global economy, Africa is set to benefit from digital outsourcing, with some individuals and communities being in a position to take advantage of aforementioned remote opportunities. However, the overall contribution of such opportunities to strengthening job markets is likely to be limited, thus requiring more systemic approaches to ensure that African countries are not left behind (Can Digital Jobs Solve Africa's Unemployment Crisis?).

Digital skills are important to ensure that the youth are prepared for the future of work in the digital economy. This is especially crucial for Africa, which is facing a demographic explosion that is set to double its population to more than two billion people in 2050, without enough jobs to cater to this growing youth population. A 2016 AfDB study showed that among nearly 420 million youth aged 15-35, one-third are unemployed and discouraged, while another one-third are employed vulnerably, largely due to a misalignment between skills and labour market requirements (Jobs for Youth in Africa).



Among nearly **420 million** youth aged 15-35 in Africa, **one-third are unemployed and discouraged**, while another **one-third are employed vulnerably**

Figure 1: Distribution of Fields of Study among Africa’s Tertiary-educated Workforce



Source - World Economic Forum

There is also a large skills gap, where employers across the region cite inadequately skilled workforces as a major constraint to their businesses, including 41% of firms in Tanzania, 30% in Kenya, 9% in South Africa and 6% in Nigeria (The Future of Jobs and Skills in Africa). Formal education in the region does not offer comprehensive IT skills, with less than 1% of children in Africa leaving school with basic coding skills. Non-formal training programmes, such as coding bootcamps, are filling this gap by offering rapid coding training as well as soft skills training to make graduates job-ready (Digital Skills Preparing Youth for the Future of Work in the Digital Economy). At the tertiary level, university curricula are failing to equip IT graduates with skills appropriate for the current and future workplace.

In this context, this report explores the source, nature, and size of the skills gap by examining existing IT skills amongst Kenya’s and Uganda’s workforces, comparing them to the skills currently and likely to be demanded by local and international employers.

It is intended that the findings of this report will:

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- › Help both universities and specialist IT schools gauge the skills gaps which exist within the IT industry.

RESEARCH METHODOLOGY



The IT jobs and skills mapping, which was conducted from August to October 2018, was organized under four key work streams, namely:

1. Situational analysis
2. Gap analysis
3. Predictive analysis
4. Recommendation development

While these work streams provided a useful guide for categorizing project activities, they were not sequential given the interdependencies of tasks across work streams.

The table below shows what information each of the workstreams sought to address and how we collected this information.

Table 2: Detailed Methodology

Workstream	Information Sought	How this information was collected (Methods/Tools)
<p>SITUATIONAL ANALYSIS</p> <p>(Nairobi, Kisumu, Mombasa, Kampala)</p>	<ul style="list-style-type: none"> • Stakeholder mapping (tech professionals, employers, competitors and associations) • Sector structure, including industry verticals • Overview of relevant policies and regulations • Employment trends 	<ul style="list-style-type: none"> • Desk research, including overview of select recruitment sites • Key informant interviews (open-ended)
<p>GAP ANALYSIS</p> <p>(Nairobi, Kampala)</p>	<ul style="list-style-type: none"> • Demand vs supply of skills and jobs • Alternative job pathways 	<ul style="list-style-type: none"> • Desk research • Stakeholder interviews (semi-structured) • Survey • Benchmarking
<p>PREDICTIVE ANALYSIS</p> <p>(Nairobi, Kampala)</p>	<ul style="list-style-type: none"> • Drivers of change • Demand and supply forecasting (skills and jobs) • Future of Work (FOW) 	<ul style="list-style-type: none"> • Demand modelling • Supply forecasting • Benchmarking • Perception-based survey
<p>RECOMMENDATION DEVELOPMENT</p> <p>(Nairobi, Kampala)</p>	<ul style="list-style-type: none"> • Opportunities • Complementarities • FOW against: <ul style="list-style-type: none"> - Geography - Pedagogy - Job placement 	

Further details on the methods and tools we used to gather information are as follows:

2.1 Desk Research

Desk-based research involved a comprehensive literature review. This collated relevant, publicly available secondary data and reports, including academic, media and corporate research. Findings from the desk research informed the foundation of the situation analysis, focusing on the following areas:

1. List and analysis of key industry stakeholders (tech professionals, employers, associations and educational providers) across Kenya (Nairobi, Mombasa and Kisumu) and Uganda (Kampala);
2. Structure of the IT sector, including a macro overview covering global and regional highlights;
3. Overview of relevant policies and regulations;
4. Relevant employment trends, for both skills and jobs.

A number of publications were reviewed to inform findings and recommendations. The full list of references can be found in the appendix.

2.2 Stakeholder Interviews

To inform the situational analysis, key informant interviews were conducted with industry players and experts at the very beginning of the study. Subsequently, qualitative, semi-structured in-depth interviews were undertaken with educational providers, employers, and associations using pre-developed semi-structured interview questions categorized around key thematic areas.

Whenever possible, in-person interviews were conducted, with Skype/phone call interviews serving as an alternative for stakeholders who were unavailable to meet in-person.

Overall, a total of 40 key stakeholders were interviewed: 24 in Nairobi and 16 in Kampala. Supplementary interviews were also conducted with 4 stakeholders across Kisumu and Mombasa.

2.3 Online Surveys

In addition to stakeholder interviews, a survey targeting IT professionals and entrepreneurs in Nairobi was disseminated using Google Forms. The survey, which combined both qualitative and quantitative questions, sought to understand the current IT landscape, as well as expectations regarding the future of jobs, work and skills. It received a total of 47 respondents.



2.4 Market Forecasting

The market forecasting exercise was a predictive analysis that sought to understand the following:

- a. Information Communication Technology (ICT) market value
- b. Higher education for technology market value
- c. Current number of IT professionals in employment and current number of IT graduates
- d. Projected number of IT professionals in employment and projected number of IT graduates

Results from desk research and stakeholder interviews were used to map out the current number of IT graduates and the current number of IT professionals in employment. Given the scarcity of data, a few relevant publications proved very useful towards providing some baseline numbers to create key assumptions for forecasts.

The next step involved an analysis of (i) survey results, and (ii) factors influencing the projected number of IT graduates and professionals in employment, which were supplemented with information received through stakeholder interviews. Microsoft Excel Modelling was used to map the forecasts.

The following publications were analysed:

1. Commission for University Education (2016), 'State of University Education in Kenya'. <https://bit.ly/2zSeIT3>
2. Communications Authority of Kenya (2016), 'Enterprise ICT Survey Report'. <https://bit.ly/2QvECS6>
3. Danish Trade Council for International Development and Cooperation (2016), 'Uganda Labour Market profile'. <https://bit.ly/2ELqFyb>
4. Government of Uganda (nd), 'Education: A means for Population Transformation, Thematic Series'. <https://bit.ly/2sp8yoA>
5. Kenya ICT Board (2013), 'Monitoring and Evaluation Indicators Study'. <https://bit.ly/2zRlHvn>
6. Kenya National Bureau of Statistics (2018), 'Economic Survey'. <https://bit.ly/2lvoV9E>
7. Kenya National Bureau of Statistics (2016), 'Micro, Small and Medium Establishment Survey'. <https://bit.ly/2xXWgqO>
8. Kenya National Bureau of Statistics (2016), 'Networking Skills in Latin America'. <https://bit.ly/2O6dNmt>
9. Uganda Bureau of Statistics (2017), 'Employment Benefits Baseline Survey Report'. <https://bit.ly/2yx-KLGR>
10. Uganda Bureau of Statistics (2015), 'Uganda Labour Force Survey'. <https://bit.ly/2yZDZZE>



RESEARCH FINDINGS

3.1 KENYA

3.1.1 General Overview

Digital jobs have the potential to create significant employment opportunities in Kenya, a country where, as of 2017, official unemployment stood at 11.47% (Statista). Currently, 18.4% of all formal sector employment occurs in occupations with high ICT intensity, in comparison to 6.7% in Ghana (World Economic Forum, 2017). For Kenya to realize the full potential of digital jobs, it requires various forms of investment across both supply and demand. The main challenge, however, is the growing skills gap, both general and tech-related.

30% of employers in Kenya identify an inadequately skilled workforce as a major constraint to their business (World Economic Forum, 2017). The World Economic Forum ranked Kenya 101 of 130 countries in the development of future skills and know-how. Kenya is not only falling short in developing skills to cater to existing demand, but also in developing future skills for a world that is set to be disrupted by the fourth industrial revolution (World Economic Forum, 2017b). Within ICT, studies conducted by the Kenya National ICT Board (KICTB, 2013) have shown that Kenya does not have sufficient local high-end skills, resulting in the domestic industry having to import such skills. High-end skill sets are found mainly among ICT professionals such as ICT project managers, network engineers, network administrators, system administrators, application developers, and information system analysts who manage complex system design, development, and integration. Furthermore, there is no law or professional body in Kenya that provides professional accreditation of computer science or information system degree programs.

A contributing factor is the disconnect between academia and the private sector, with universities offering curricula and teaching practices that are often out of sync with the needs of the job market. For example, one stakeholder spoke of a “huge translation challenge” between employers and computer science graduates, as the latter often struggle to articulate and position their academic experience in a way that makes sense to prospective employers. While complementary programs are springing up, like Andela, Moringa, and ALX, some recruiters are not sure of their capacity to absorb all the graduates that are emerging from universities each year. Technology hubs such as iHub also play a significant part in IT skills development, while there is a growing role for online platforms such as Udemy, Udacity, and even YouTube. This reflects a fragmented supply landscape with limited cross-pollination across various actors. One executive in a technology multinational corporation mentioned that talent is tough to source locally, as there is no obvious central place to go to; if such a place exists, it is not well publicised.

This translation challenge also extends to demand. Fragmented supply results in a “perceived” gap in talent, even in cases where that gap may not exist or is smaller than it is believed to be. Combined with a limited understanding of the scope of IT skills and their application in various industries and job functions, the result is a lack of clarity in what employers are looking for. This compounds the disconnect between demand and supply for IT skills. In light of this, there appears to be increasing interest in data-driven hiring facilitated by talent sourcing firms.

3.1.2 IT Skills & Jobs Supply

3.1.2.1 Skills Development



Universities



Hubs



Complementary Programs



Online Platforms

1. Universities

The primary challenge in Kenya's IT sector is the growing skills gap, caused mainly by universities developing a workforce that is neither guided by a human resource development policy, nor well aligned to industry needs, especially at the higher end of the spectrum (MICT, 2017). Most ICT faculties do not have industry experience, are not active researchers (due to limited funding and high teaching loads), and lack of active doctoral degree programs. Since many universities are relatively new, there is an inadequate number of doctoral-level and high-quality ICT faculties. Further, there are limited industry-university linkages through attachments and joint projects (Kenya ICT Board, 2013).

All stakeholders agreed that public universities in Kenya do not provide the right skills to match market needs. With a growing tech industry, universities are slow to catch up with evolving demand for IT skills and emerging technologies, which forces a lot of students to teach themselves. Even when universities try to stay ahead of trends, for instance by forging industry ties, the Commission for University Education still must approve curriculum changes; ultimately, this sets the pace.

The curriculum taught in universities is not up to date, and so does not give graduates relevant skills that can be applied in jobs immediately; too few classes offer skills which are needed in the IT market. For example, several Kenyan universities are teaching programming languages like C++, despite companies looking for graduates with an in-depth knowledge of Java and Scala programming languages. A consummate freelancer remarked that JKUAT did not teach him even basic skills, and that when learning C++ he had to do so by writing code on paper. Consequently, he decided to learn how to program by himself, starting with Java and in due course other programming languages. Furthermore, there are limited attempts to get ahead of emerging and upcoming IT trends - for example, the University of Nairobi has only one AI and no gaming class.

The current status of Kenya's higher education forces many students to find requisite skills training elsewhere, including in developed nations. One IT executive, who studied in South Korea for both his Master's and PHD, highlighted that cyber security programs in Korean universities were deep and intensive, with research projects funded by the universities. Students learn Python in their first year and attend several conferences. In contrast, students in Kenyan public universities are not accorded the same opportunities or facilities, and it is difficult to coordinate and convene varied stakeholders for conferences and other industry events.

Despite this scenario, some higher education institutions recognize the need to update their offerings to reflect IT industry trends. Mount Kenya University (Egerton) is one such example, while USIU has been making a concerted effort to improve their curriculum to suit market demands, hosting an IT stakeholder meeting to receive feedback on their curriculum from relevant industry players. Several universities are introducing a Bachelor of Business and IT degree, focusing on both the IT and business skills that are essential for a product manager.

The leader appears to be Strathmore University, which has a faculty of IT as well as informatics; it offers diplomas, certificates, undergraduate degrees, Masters' and PhDs. Most of their students are being trained to become developers, with a smaller number being trained to understand digital strategy, equipped to lead the transformation of the industry. With that in mind, Strathmore Business School is in the process of setting up an Emerging Tech Hub targeting industry, public sector, and academic partners. The objective of this is manifold:

- To sensitize the C-Suite level on the benefits of emerging tech and introduce some urgency around it.
- To help build a base for thought leadership in the IT industry, which is currently lacking.
- To convene relevant stakeholders in the public sector, private sector, and academia, to have relevant conversations on emerging tech.

With the launch set for February 2019, Strathmore hopes to position itself at the centre of what is currently a fragmented industry, and to encourage greater coherence.

2. Hubs

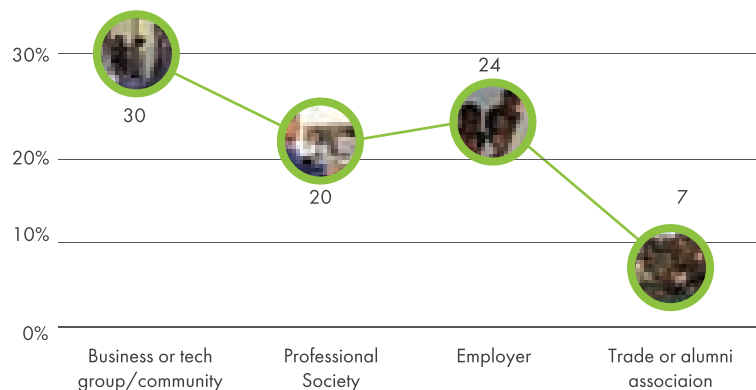
Kenya is at the forefront of innovation regionally, as local entrepreneurs develop products inside small tech communities and social groups. International and local companies, local entrepreneurs, university students and government agencies are forming innovation hubs around the country, with some of the most well-known being iHub, m-Lab, FabLab and Nailab.

A further addition is Cisco Systems' innovation hub, which opened in Nairobi during September 2018, seeking to tap tech enthusiasts.

These hubs were lauded by respondents as playing an important role in sensitizing people on the significance of tech and introducing people to new technologies. Kenya is ahead of regional neighbours through the early exposure to meetups, and the influential role these hubs have played in telling the wider population about current technologies, making them more marketable. Hubs have provided the tech community with facilities and the opportunity to focus on young entrepreneurs, web and mobile phone programmers, designers and researchers. In addition, they are targeting emerging technologies like AI, machine learning, and IoT. According to our survey of IT professionals and entrepreneurs, business or tech communities constitute the greatest source of their professional development, which includes training, skills development, and career guidance.

Figure 2: Sources of Professional Development

Which is the greatest Sources of Professional Development?





3. Complementary Programs

Most stakeholders identified Andela and Moringa School as the key complementary program providers that are bridging the existing IT skills gap, with Code for Africa and Code for Girls also cited. These programs offer language-specific courses and technical skills that match the job market, including subjects not available in universities.

Andela was highlighted by respondents as being differentiated by its stringent selection process and emphasis on soft skills, including cultural fit.

Another significant complementary program that recently launched in Nairobi is the African Leadership University's (ALU) 1st year leadership core curriculum, ALX, which emphasizes cross-cutting skills for the workplace.

Figure 3: Case Study - ALX

SPECIALIST EDUCATION PROVIDER SNAPSHOT (1): ALX

ALX is a leadership, entrepreneurship, and a life-long learning community comprising two main components: the Xcelerator and the Launchpad programs. The ALX Launchpad is based off of the African Leadership University 's 1st-year Leadership Core curriculum. The program runs over the course of 6 months (4 days a week, 3-4 hours a day), combining in-person workshops and seminars, with experiential learning and collaborative projects targeting post-graduate students (under the age of 25, though there is no degree requirement to join the program).

The Launchpad consists of 4 tracks: Projects, Data and Decisions, Communicating for Impact, and Entrepreneurial Leadership. These tracks teach 8 meta-skills:

- Self-leadership
- Critical thinking
- Entrepreneurial thinking
- Managing complexity
- Quantitative reasoning
- Engaging with others
- Effective communications
- Systems thinking

A part of ALX's value proposition is job placements for its Launchpad graduates. The program's success is measured via four key metrics:

- In the immediate term: number of job placements
- In the immediate term: level of job performance and employer satisfaction
- In the longer-term: number of ventures launched
- In the longer-term: number of jobs created

ALX also offers a 6-month leadership accelerator program for mid-level managers, the Xcelerator. The Xcelerator seeks to develop foundational mindsets and behaviours in mid-level managers equipping them to accelerate their professional growth and deliver real impact in their organizations.

Program costs:

- US\$2,000 for the post-graduate ALX program, funded through a Contribution Agreement (an income sharing arrangement)
- US\$2,000 for the leadership accelerator program, delivered through a B2B model, where organizations sign up a number of their mid-level managers

Both the Launchpad and Xcelerator programs utilize the latest technologies and methodologies to deliver the trainings. Content and submissions are made using online collaboration tools that are quite popular world over, including the Edx MOOC software, Google Suite products, collaboration tools like Slack, Asana and so on. This goes a long way toward introducing participants to some world class tools used to increase efficiency, productivity, and to collaborate.

ALX's mission is to catalyse the transformation of Africa by empowering its biggest untapped resource – its people. Based in Nairobi, Kenya, ALX has plans to expand to 10 different cities in Africa and beyond over the next 5 years.

Figure 4: Case Study - Moringa School

SPECIALIST EDUCATION PROVIDER SNAPSHOT (2): MORINGA SCHOOL

Overview of Moringa School

Moringa School is a Nairobi, Kenya-based multi-disciplinary learning accelerator committed to providing young Africans with digital and professional skills training. Through experienced teachers and mentors, a blended learning model, and a market and outcomes-driven curriculum, Moringa School's mission is to transform higher education throughout Africa and enable its graduates to be globally competitive with their peers. The school has placed more than 95% of its graduates into leading companies throughout Africa and the world. Moringa School was named one of the 'Top 10 Most Innovative Companies' in 2018 by Fast Company.

In addition to Kenya, Moringa School has offered its curriculum in other regions including Pakistan through partnerships with the World Bank and Pakistani government, Hong Kong in collaboration with Accelerate, and Ghana with Meltwater Entrepreneurial School of Technology. Moringa School plans further expansion to Uganda and other markets in 2019.

Founded in 2014 by Audrey Cheng, Moringa School is registered with Kenya's Technical and Vocational Training Authority. The school was awarded Financial Times and IFC's "Finalist - Achievement in Sustainable Development, With a Focus on Education, Knowledge and Skills."

Outside of Moringa Prep and Core, Moringa School also runs SPOC (a secondary school practical open source content project), which aims to be in every secondary school in Kenya to introduce students to coding at a younger age. Moringa also runs Nairobi Tech Week, Sub Saharan Africa's largest event series for product makers.

Courses Overview

Software Development

Moringa Prep is an introduction to Programming Course that lasts 5 weeks. It is for beginners to learn the fundamentals of programming or the more established developers looking to sharpen their base of frontend skills. The languages offered are HTML, CSS and JavaScript. Moringa Prep is \$400 (Ksh40,500)

Moringa Core is a 15-week course for beginners to learn more advanced development skills. Their courses consist of different pathways that branch into full stack and mobile development. For full stack Moringa School offers the Python programming language and Django framework. For the mobile development track, Moringa School offers Java and Android. Moringa Core costs \$1600 (Ksh 140,000). There is a \$200 discount for individuals who have gone through the Moringa Prep Program.

Data Science

Data Science Master Class is a day-long program (8 hours) that aims to give participants insightful in-depth knowledge and advanced practical skills in data science. The class covers fundamentals of Python, R and concepts like datasets, linear regression models and Supervised Machine Learning Algorithms. The course costs \$80.

Data Science Full-time class is the more intensive program that builds on from the Master Class by introducing both foundational and complex concepts in addition to practical elements that help participants get on the pathway to becoming a fully-fledged professional Data Scientist. The course lasts five months and covers concepts such as managing and curating data, exploratory data analysis and big data.

Teaching Methodology



Moringa School is committed to offering a comprehensive, technology-focused curriculum that is designed to equip post-secondary students with the necessary technical and workplace skills to pursue and secure meaningful employment throughout Africa and the rest of the world.

- Blended learning model (majority of content online) with advanced technical mentors answering students' questions, simulating a real working environment
- Tested learning management system that tracks the progress of students and alerts technical mentors to which students need more attention
- Specialized learning - focus on Android or full-stack development
- Paired programming and project-based learning

Self-paced education, peer teaching

Support from other students + supportive and strong alumni base

Classroom culture centred around autonomy, ownership, reliability, and transparency through values of proactive participation and self-awareness



Figure 5: Student Profile - Nombuyiselo Murage, Moringa School

STUDENT PROFILE: NOMBUYISELO MURAGE, MORINGA SCHOOL

I am a 26-year-old Kenyan citizen. A Geomatics engineer by training, I am currently working as a backend software engineer at Gro Intelligence, which is an agricultural-technology company headquartered in New York. My role is to develop and implement workflow designs to harvest, process, and input data from various sources into our platform.

I graduated with a Bachelor's degree in Geomatics Engineering and Geospatial Information Systems (second-class upper division honours) in July 2016. In January of that year, I landed my first job as a GIS Analyst in a Kenyan engineering-survey firm called Geomatics Civil Engineering Surveyors (Geomatics CES) Ltd in Nairobi, Kenya. Within four months, I was appointed the Lead GIS Analyst for the Nyandarua County Spatial Plan. I had to coordinate all GIS matters including data collection, validation and final production of the town base maps. I developed extensive skills in data collection, the creation of spatial datasets, geodatabase creation and maintenance, and project management.

My experience working on the Nyandarua County Spatial Plan exposed me to the importance of managing fairly large datasets using geospatial tools and programming languages. I needed to be able to process data faster and more efficiently and I found myself increasingly interested in computer programming as a way to overcome the challenges I faced. The limited experience I had with programming was a little python scripting related to my field using ArcPy, in which I was mostly self-taught.

In November 2016, I decided to quit my job and pursue a professional course in software development at Moringa School where I took a 6-month coding accelerator program and graduated with a certificate in Computer Programming in June 2017. The modules I took while at Moringa School included

- Introduction to Html, CSS and Java Script (5- week prep-class).
- Java - Android Track (6-month intensive track)

After Moringa School, I re-entered the workforce as a software engineering intern at Gro Intelligence and, thereafter, I was promoted to a full-time role as a back-end engineer. Moringa contributed a great deal in helping me secure the internship.

Despite not directly applying the technical skills I learnt while at Moringa, as a result of my training there, I was more than capable of jumping into new technology stacks with relative ease. This is due to the fact that, above all else, Moringa School equips students to understand underlying technical concepts and principles, which allows us to adapt to different technologies quickly.



4. Online Platforms

Due to the shortcomings of formal institutions, many people end up training themselves. YouTube, for example, offers both structured and unstructured courses that help people gain relevant IT skills, including in relatively sophisticated areas such as AI.

Others use websites which charge a fee: many stakeholders mentioned that a lot of developers and coders rely on websites such as Coursera, Udacity and Udemy. Several courses are offered in Ithaca covering cyber security, including certification programs such as the Offensive Security Certified Professional (OSCP).

3.1.2.2 Skills Availability

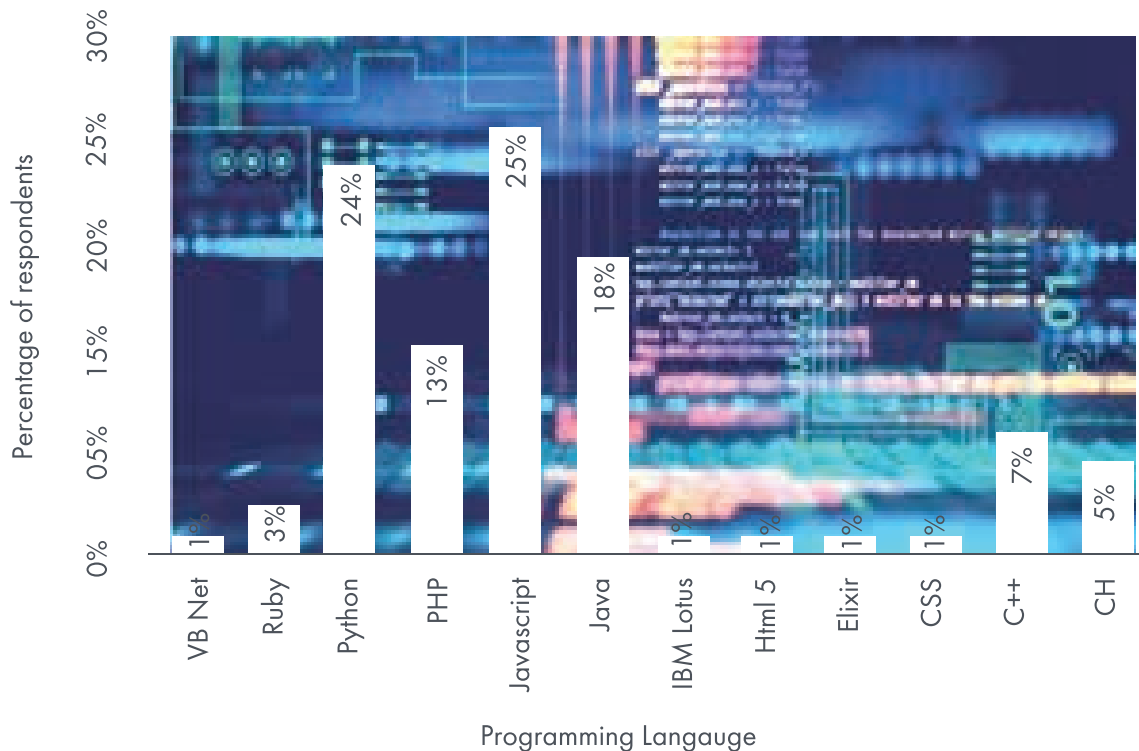
A 2017 Stack Off Kenya report by Zegetech on the latest trends in software development surveyed over 500 developers to understand by which areas of development they are most excited, the languages they choose, and tools they use to create. It shows that 46% of developers identified as full stack developers, 16% as backend developers, 8% as frontend developers, 7% as mobile developers, 3% as data scientists, and 2% as UX designers.

In the list of programming languages and frameworks, Java and Node took the lead; Python came second and PHP third.

Just over 30% of the 500+ respondents had over 3 years of experience, half of whom had over 5 years. There is a clear indication of the need for mentoring new developers in a highly unstructured ecosystem. Asked what they were learning next, AI and Python topped the list, with blockchain and data science following closely.

Figure 6: Programme Language Proficiency (Nairobi)

Programming language percentage proficiency (Nairobi)



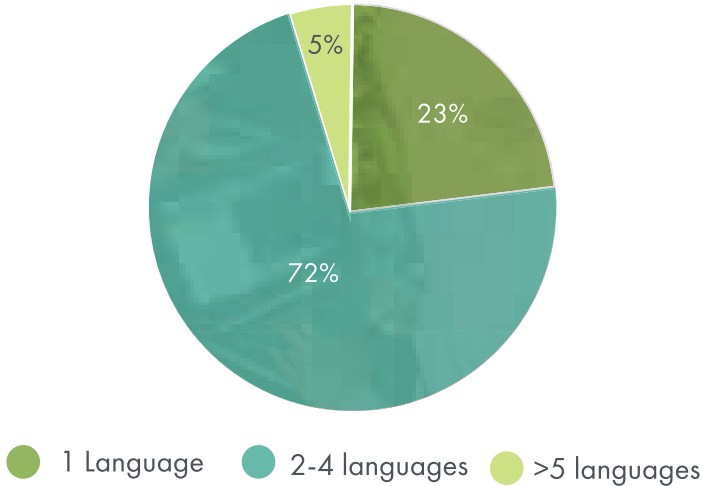
As per the report, to begin work, developers need HTML, CSS, Javascript, and Typescript. To become a backend developer, the report shared that one or more of the following languages should be learnt: Java, Python, PHP, Ruby, and Elixir. According to our own survey, Javascript (25%), Python (24%), Java (18%), and PHP (13%) are the top 4 programming languages in which IT professionals are proficient.

72% of surveyed IT professionals are proficient in 2-4 programming languages. 23% of IT professionals are proficient in 1 language, and only 5% of the surveyed IT professionals are proficient in more than 5 languages.

Furthermore, the majority (82%) of survey respondents are proficient in software development.

Figure 7: Proficiency by number of programming languages (Nairobi)

Proficiency by number of programming language






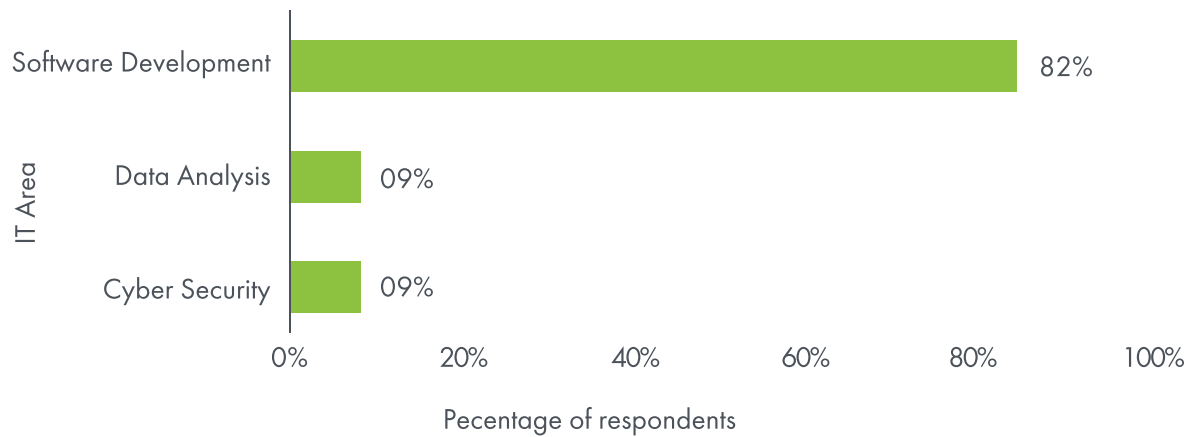
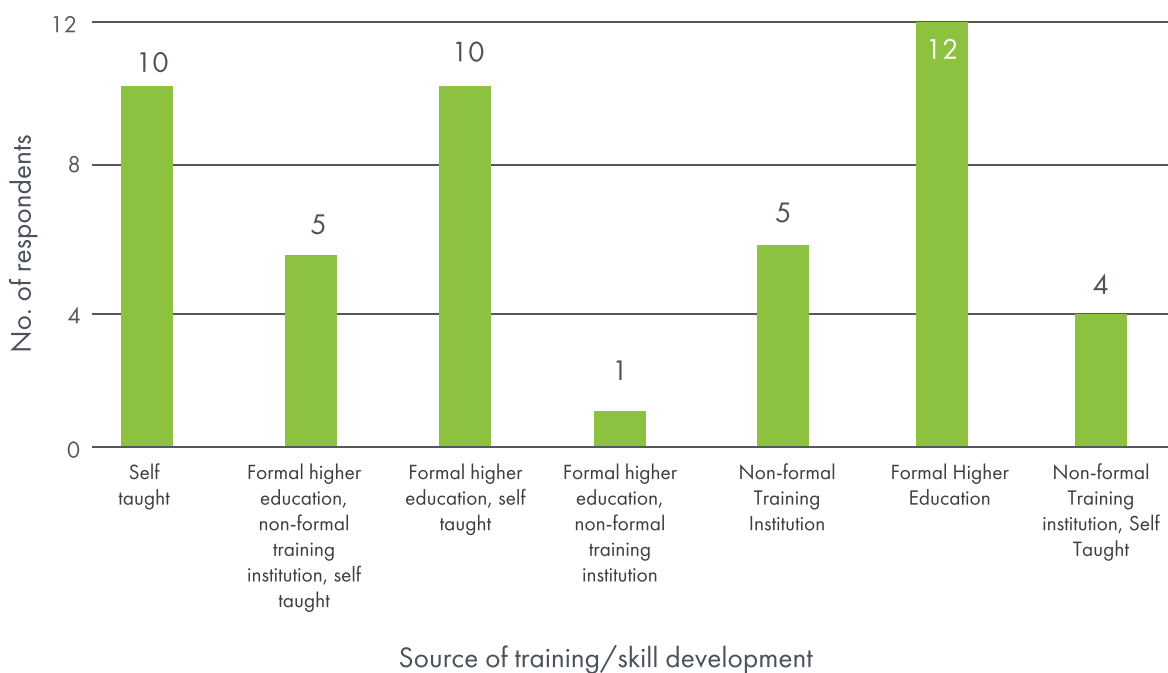
 <p>40.3% of the 500+ respondents are self taught</p>	 <p>72% of surveyed IT professionals are proficient in 2-4 programming languages.</p>	 <p>Javascript and Python are the common programming languages among Kenyan and Ugandan developers</p>
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Figure 8: Proficiency by IT Area (Nairobi)
IT Area percentage proficiency



A significant proportion (25.5%) of survey respondents were trained exclusively in formal higher education institutions, followed closely by those who were self-taught (21.3%). Notably, the number of people who used a combination of formal education and self-teaching also stood at 21.3%, corroborating our interviewees, who stated that self-teaching is an increasingly popular form of skills development in the IT space.

Figure 9: Source of Training / Skills Development
From where did you receive your training/skill development?



Notably, when disaggregated, the data reveal that the largest percentage of respondents are self-taught (40.3%), followed by formal higher education (38.9%), and, finally, non-formal training institutions (20.8%).

3.1.3 IT Skills & Jobs Demand

3.1.3.1 Sources of Demand

1. Start-Ups and SMEs vs. Corporations

According to stakeholders, there are two main sources of demand for IT skills: traditional employers, which consist primarily of larger corporations, and non-traditional employers, such as start-ups and SMEs. While freelancing does constitute a notable source of employment, at this stage there is insufficient data to draw detailed conclusions.

A key question that underpins any analysis of how these two sets of employers think about and source IT skills is, 'How do companies think about innovation?' Interviews suggested that larger organizations with dedicated IT departments tend to look for more traditional IT skills, centred around administration. They usually look for package solutions and customized applications. These employers have different levels of technology incorporation in their business models, which affects their demand for specific IT skills.

Non-traditional employers tend to be more receptive to innovative IT use than larger establishments. They need people that can build internet applications, cloud compute, and develop systems from scratch. While these non-traditional employers are a likelier source of job growth over time, their main constraint is an inability to pay for senior, higher quality talent.

Companies usually prefer to pick software engineering graduates straight from university and upskill them with knowledge specific to the needs of the organization while start-ups have mostly hire one or two highly experienced senior developers who can immediately create a product within tight timelines



In contrast to these limited budgets, corporates have the capacity and bandwidth to train IT graduates. They can take in entry-level and intermediate developers since they have larger teams that can offer mentorship and guidance. Companies usually prefer to pick software engineer graduates straight from university, and use people in the company to upskill new employees with knowledge specific to the needs of the organisation. On the other hand, start-ups have no option but to hire one or two senior developers, usually with 4-5 years of experience, who can immediately create a product within tight timelines. As the companies grow, they become able to recruit at varying skill levels.

An example is Innova, which develops financial software products in Kenya; having begun with just two founding employees who built the initial products, they have expanded to thirty employees, now recruiting developers directly from university.

2. Industry Verticals

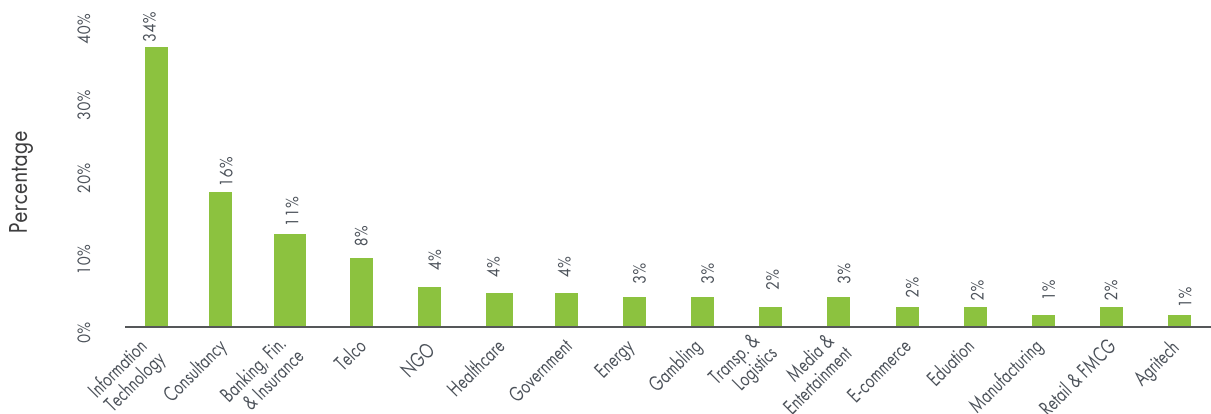
The telecommunication and finance industries are the most mature in technology adoption. Respondents were careful to distinguish between financial services and banking as two distinct verticals, calling particular attention to insurance firms and micro-credit companies as having a lot of data-driven decisions around products and profit optimization. Risk and fraud detection in both banking and financial institutions were highlighted as areas that increasingly require technological solutions and skills.

Beyond these, stakeholders flagged the following sectors as exhibiting increasing technology adoption:

- a) Healthcare – Flare, which provides software infrastructure and operational support for emergency response teams, was cited frequently as an exemplar.
- b) Education - numerous ed-tech companies exist in Kenya.
- c) Agriculture - one respondent mentioned working with a fertilizer producer that is building a digital team to help digitize their processes, another mentioned the example of precision farming.
- d) Energy - renewable, as well as oil and gas.
- e) Transportation and logistics - including aviation.

Based on analysis of 179 jobs in Nairobi across 7 job boards over a 6-month time frame, the top 4 industries with the highest demand for IT jobs are Information Technology (34%), Consultancy (16%), Banking, Finance & Insurance (11%), and Telco (8%). Developers are in high demand across these areas, while the fintech industry has high demand for data-related skills. Senior managers in IT are in highest demand in the consultancy industry.

Figure 10: IT-related Job Postings by Industry (Nairobi)



Several experts noted that many industries have yet to fully understand that technology is not an impediment to business, but an enabler. There are still many companies that view IT as a predominantly administration role focused on network maintenance, without considering other ways in which it could bring more value to their business. This limited understanding also affects the IT hiring process, as outlined below.

3.1.3.2 Hiring

Interviews indicated that a problem with the Kenyan IT job market is not that demand is limited or does not exist, but that businesses often do not know who to hire, what they should be looking for, or how to deploy IT skills.

Anecdotally, there were numerous examples to corroborate this. An executive at a multinational technology company stated that a significant part of their work involves working with clients to help them identify and understand ways in which data and technology can help improve their bottom line. A business coach at a reputable leadership program provided the example of e-commerce companies that only recognize and value skill sets in social media and marketing, disregarding the back-end IT skills that are critical to building and running an e-commerce platform.

Meanwhile, a respondent from a talent sourcing firm spoke of pervasive misunderstanding among employers around different types of roles and what they entail. Specifically, she highlighted that:

Data scientists are frequently conflated with data analysts. This was reaffirmed by a stakeholder representing another, more industry-agnostic recruitment firm. While analysts tend to be role/industry specific, with lots of templates from which they can draw for their work (e.g. credit analysts from financial services backgrounds, research analysts, or business analysts), data scientists do not work off templates and tend to engage in more discovery and building.

On the product side, employers often confuse product managers with project managers, product owners with solutions managers, and heads of growth with marketing functions.

On the design side, there is limited understanding of the distinctions between brand-related roles, UI/UX roles, design researchers, and design strategy roles.

As a result of this lack of clarity around job functions and titles, HR personnel do not always know what they should be looking for and end up “copy-pasting” job descriptions from the internet.

Aside from role confusion, a respondent responsible for IT recruitment noted that what is considered to be middle and senior level in the market does not always translate exactly on the ground. In terms of technical skills, people usually sit at a lower level than how they classify themselves: people with 2 years’ experience will refer to themselves as mid-level, even though a recruitment firm we spoke to qualifies “junior” as someone with one year of experience with intermediate skill sets in a programming language and database framework.

This “inflation” problem was corroborated by how various employers define junior developers. One interviewed employer referred to a junior developer as an entry-level developer straight from university, stating, “One becomes an intern first, and later proceeds to becoming a junior developer as a full-time staff.” The aforementioned analysis of seven job boards revealed similar classifications, with postings referring to 2-3 years of work experience as “mid-level” and 5 years of work experience as “senior”.

This lack of clarity and awareness around roles can result in a misconception among employers that talent may not exist, even when it does. It also suggests that with greater sensitization around the availability of IT skills and the best ways in which to deploy them, it is possible that demand could be boosted and become better aligned with supply.

3.1.3.3 Skills and Roles

Based on the job board analysis, the following are identified trends around job postings for IT-related positions:

- Developers are in highest demand, with more than 50% of all IT-related job postings in search for developers. The majority of these jobs are looking for mid-level applicants with between 2-5 years of experience.
- IT Admins are second in skills demand at 18% of all IT-related job postings. They are in highest demand in the IT, government, and consultancy industries.
- Senior managers in IT are third in demand at 11% of all IT-related job postings. Posted jobs include CTO, Digital Channels Tech Lead, Regional IT Coordinator, Head of ICT, and IT Manager. These senior manager roles are in highest demand in consultancy and banking, finance and insurance industries.
- 4% of all IT-related job postings are data and business intelligence related roles. Some of the listed jobs include: data analyst, data scientist, data engineering, business intelligence manager, business intelligence and analytics.

Figure 11: IT-related Job Postings by Role (Nairobi)

IT-related job posting by role (Nairobi)

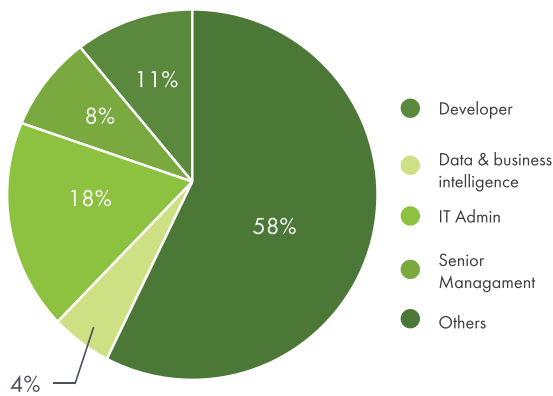
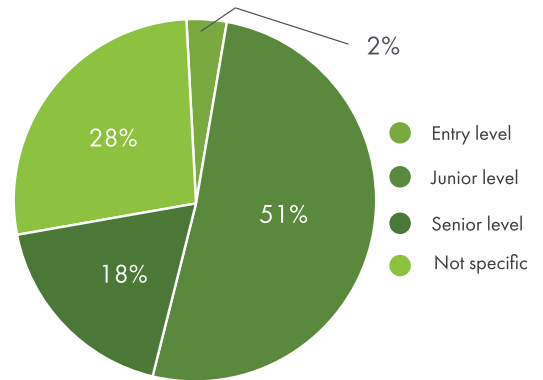


Figure 12: IT-related Job Postings by Job Level (Nairobi)

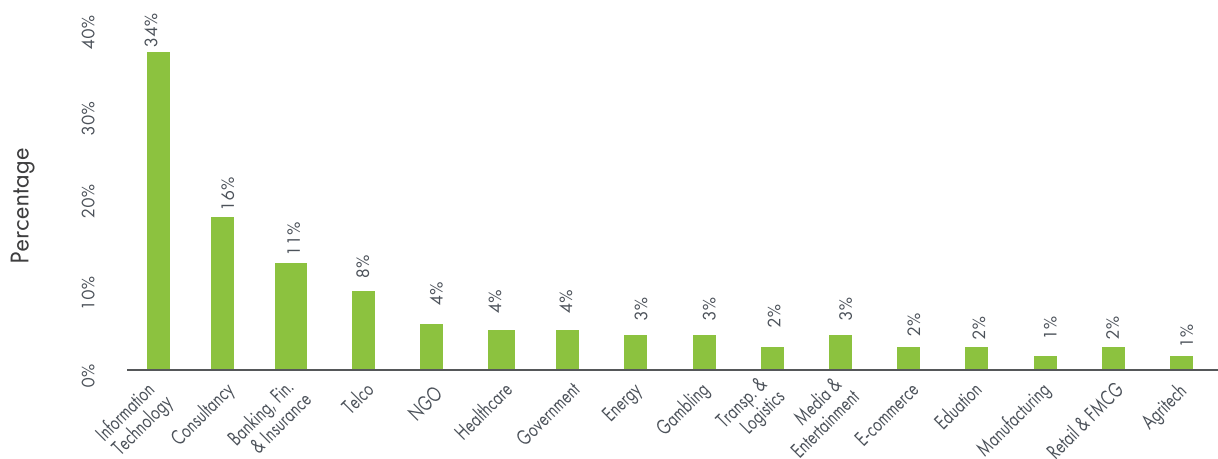
IT-related job posting by level (Nairobi)



More than 50% of all IT-related job postings are looking for mid-level applicants with 2-5 years of experience. 28% of jobs have not specified their experience requirements. 18% of jobs are looking for senior-level applicants, with only 2% of jobs hiring at entry-level.

The IT industry has the highest demand for IT-related skills, accounting for 34% of all IT-related jobs posted, followed by consultancy at 16% and the banking, finance and insurance industry at 11%.

Figure 13: IT-related Job Postings by Industry (Nairobi)



The stakeholder interviews corroborated these and additional trends:

1. Technical Skills

Most if not all respondents agreed that there is growing but unmet demand for IT skills both within and outside the IT industry. Some roles in particular are very difficult to fill, notably data scientists (they tend to work at banks or as consultants, rarely willing to move from existing jobs), quality assurance (e.g. optimization, efficiency, accuracy of results), design researchers, and product-related roles.

i. IT admin roles

An IT admin is in charge of maintaining a company's IT network, servers and security systems. Conversations revealed that there is steady demand for IT admin roles in activities like networking, hardware and software maintenance, as well as people who can run an IT department within an organization. This type of skill set is generally available.

ii. Engineers and developers

Most interviewees identified a growing demand for front-end and back-end engineers, with a particular shortage of front-end engineers. At the entry level, companies tend to hire engineers and developers straight from university, building skills specific to their organization. This said, despite being in high demand, there was the suggestion that there can be a 6- to 8-month employment gap due to the disconnect between university and industry needs.

Nonetheless, this leads to a substantial pool of mid-level software engineers. However, there is a shortage of senior engineer developers, who tend to know their worth and demand high compensation; many employers interviewed mentioned how expensive it is to hire them, forcing outsourcing to countries such as Ukraine. Respondents also remarked that there is a stark disparity in competency among engineers and developers with similar length experience; some are ahead of the curve and can code in new languages such as React, while others are unable to build an end-to-end framework. A few employers noted reservations around the reliability of engineers and developers. According to one respondent, "Talent is there, but attitude and work ethic are not." She went on to speculate that engineers and developers may be more prone to missing deadlines since they usually juggle multiple jobs simultaneously.

iii. Data scientists

One recruitment firm conducted a study in 2016, interviewing 150 firms across different industries, encompassing a mix of start-ups and companies. Through this process they identified a deep need for data scientists and software engineers. Since then, they have identified 1,500 jobs in East and West Africa for data scientists alone, which often go unfilled for up to 9 months. Meanwhile, only 9% of our survey respondents indicated proficiency in data analytics skills. While the need does exist – notably among technology firms or firms that have technology products – the market is relatively narrow due to the aforementioned confusion around what data scientist roles actually entail. Locally available talent is too junior to be able to tackle end-to-end data science projects

fully and on their own, whether leading a team or running a standalone project. Companies normally have to source internationally for senior roles, for example from India and other countries where students are educated in these fields early on. The predominant need is for mid-to-senior rather than junior-level candidates, because often there is no capacity within the company to absorb less experienced talent.

This shortage means that salary bargaining power usually rests with the candidates, especially at more senior levels; often, they are headhunted and relocated from abroad.

iv. UI/UX Developers

There is growing demand for UI/UX developers for web and mobile platforms. Though UI/UX roles have existed for a few years, they remain difficult to recruit for most of the existing talent pool sits at the junior to mid-levels. According to one prominent interviewee, “Moringa school has been doing some great work” alongside the likes of iHub and Nairobi Design Institute, both of which offer courses and networking opportunities. However, a formal certification program, which accredits individuals under the broader umbrella of Human-Computer Interactions is missing.

One respondent at a product-focused tech company, explained that both employers and those within the tech community do not understand fully what “user experience” is. A lot of people end up conflating UI and UX, misunderstanding the full breadth of scope of both fields.

v. Tech HR Managers, Business Developers & Lawyers

There is a growing need for HR managers who understand tech and can recruit the right talent in terms of technical evaluation and recruitment. Findings reveal that several HR departments do not understand technical roles and skill sets and, consequently, end up asking for requirements that do not make sense. For example, some demand that applicants have 5 years of experience with a new programming language which is less than a year old, such as Swift. A respondent quipped, “What are they looking for? The inventors of the language?”

Beyond hiring, several stakeholders agree that understanding technology is essential across all different job descriptions. One employer shared that the most difficult people to hire in the space are business developers who understand the telecommunication sector, as well as lawyers who understand payment regulations across the continent.

vi. Project Managers

Project managers oversee the process of planning, executing and delegating responsibilities around an organization’s IT pursuits and goals. According to one stakeholder, project managers are often confused with product managers despite the two having very different skills and job descriptions. Globally, there is a widening gap between employers’ need for skilled project management workers and the availability of professionals to fill those roles. Several stakeholders noted the same project manager skills gap in Kenya.

vii. Enterprise Software Developers

There is a growing demand for enterprise software, which is computer software used to cater to the needs of an organization rather than individual users. According to one stakeholder, enterprise software development entails two distinct requirements and demands. Firstly, the traditional enterprise software platforms demanded by typical corporate companies, which are large enterprise platforms that need to be customized to fit the corporate business model. Companies usually source these platforms from agents and look for products that are stable and have already been proven to work.

The second area of demand is for technology platforms for start-ups and SMEs. These organizations usually require developers to create something new and to build a platform that is customized to their needs. In contrast to corporates, these entities are more likely to work with a developer to create a product which works for them, rather than adapt an existing product.

viii. Product Managers

Product managers are people who can bridge the gap between business and technological needs, similar to an architect in the construction sector. There is a notable dearth of product managers globally; only a handful of countries have an adequate supply of product managers, such as the US, the UK, and Israel. In emerging markets, their scarcity is severe; it is rare to find people who understand the business and like to think strategically, while also possessing strong technological understanding. When product managers have business acumen but limited technical skills, typically the result is products that are either impossible to build or extremely costly.

ix. Tech Advocates

Broadly, tech advocates are those who can publish relatable content on developments within the IT space. Most respondents shared that there is a need for sensitization among both the general public and private sector of the importance and benefits of technology. In light of this, there appear to be relatively under-explored roles within developer advocacy.

viii. Product Managers

As start-ups and companies look to scale their businesses, there will be growing demand for scaling skills. Micro services developers are vital to help enterprises address this challenge. Their skills include containerization, back-end development, and scaling programming languages such as Java. Proficiency in data analytics and business intelligence are also needed to grow companies successfully.

Several industry verticals, such as e-commerce, the public sector, and fintech would benefit from using micro services architecture. One stakeholder shared that the Kenya National Examinations Council (KNEC) has a scaling problem during the KCSE/KCPE results period, when their website cannot cope with the number of people checking results. KNEC could use microservices infrastructure to handle the increased traffic during the announcement of KCSE and KCPE results, and rent out the infrastructure to clients during the rest of the year.

2. Programming Languages

Interviews indicated that the following languages are in high demand:

- Python, ranking first
- Javascript - along with React, which is used to build Java Script interfaces
- PHP
- Java

This tallied with the findings of the aforementioned survey, where respondents cited greatest proficiency in Java Script, Python, Java and PHP, signalling an alignment between demand and supply.

In addition to technical competencies, roles such as Tech Advocates, Product Managers, and Business Developers point toward the need for competency in soft skills. According to one recruitment firm, while there are over ten coding schools, many focus exclusively on teaching technical skills. This neglects the importance of soft skills such as teamwork, communication, work ethic, attention to detail, and problem solving. Leadership skills were also identified as lacking in the tech community, such that the blend of both technical understanding and managerial competence is rare; this demonstrates a need for training in both foundational tech and managerial administration.

One expert pointed out that by focusing on the methodology behind developing an application, the need for problem solving and project management is more apparent. Engineers must first develop the architecture, test it, and review it; they must carry out unit and scalability testing before launching the product; and they must create mechanisms to collect and assess data. Such an approach is taught rarely in universities

3.1.3.4 Alternative Job Pathways: Freelancing and Remote Work

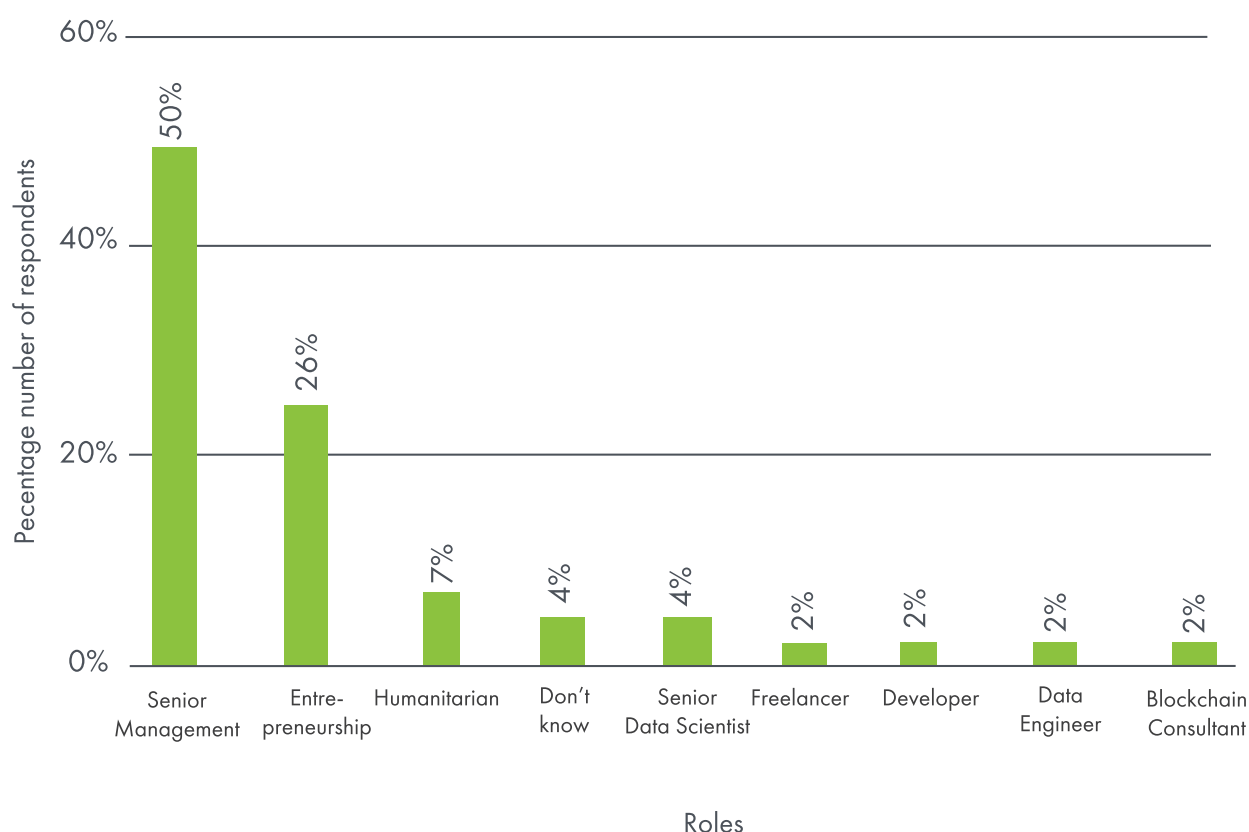
Kenya has successfully positioned itself as an emerging hub for the global digital business process outsourcing (BPO) sector, where roughly 7,000 Kenyans work in BPO, mostly in voice-based services and transactional back-office services (World Economic Forum, 2017). Most outsourcing jobs come from the US, whose companies use Kenyans due to lower wages and high-quality work.

Growth of BPO, online work, and digitization is driving demand and creating job. By 2025, new work formats such as online platform work could result in 536,000 additional full-time equivalent jobs and a US\$3 billion increase in Kenyan GDP (WEF, Future of Jobs and Skills in Africa). In the meantime, this freelancing is a vital source of higher incomes. While IT jobs in Kenya might pay between KES 80,000 and KES 150,000 per month, through freelancing this can be earned within a week.

Several freelancing platforms are available, both local and international, including Upwork, KuHustle, freelancer.com, and gun.io.

Interestingly, when survey respondents were asked where they saw themselves professionally in the next 5 years, half indicated that they were interested in senior management positions, i.e. formal employment. This was followed by entrepreneurship at 26%. This suggests that formal employment in the IT sector is still the most established pathway towards jobs.

Figure 14: Future Outlook on Roles



3.1.4 Market Inefficiencies

1. The IT industry is still young

Kenya's IT industry is relatively nascent; most tech has been available in the region for less than five years. As such, there is a paucity of professionals with several years of work experience, as it takes time for the industry to develop its base skills. An expert shared that an established company should aim for at least 30% of its IT team to have professional experience of ten years or more. Consequently, senior professionals are in high demand and companies are often forced to source talent from abroad.



2. Companies do not yet understand the importance of IT

As highlighted in 'Who are they looking for', many stakeholders shared that beyond finance and telecommunications companies, most organisations still do not understand the role and importance of IT in their day-to-day business. A stakeholder who works alongside senior management in the region shared that a lot of management still views an IT admin as someone who just does network administration and connects one computer to another. This translates directly into the hiring process, where some companies do not understand what type of IT skills they need. A failure to address this issue will likely lead to prolonged skills gaps in emerging technologies, such as cloud computing, big data, and machine learning.



3. Lack of collaboration between the industry and academia

There is a lack of collaboration among all stakeholders in the industry, the most significant of which is the disconnect between academia and employers. Cross-pollination between the private sector and academic/training institutions is critical for industry development. Lessons can be learnt from abroad: for example, Dr Fei-Fei Li is the Head of AI and Machine Learning at Google, but also a part-time lecturer at Stanford University, bringing rich practical experience to the classroom. This sort of collaboration between industry players and learning institutions in Kenya would go a long way in bridging the existing gap.

4. Policy and Regulatory Environment

Several African governments are passing policies detrimental to the IT industry. Benin is the latest to impose a social media tax, joining Uganda and Zambia as African countries that have imposed levies on the use of social media. Fortunately, the Government of Kenya (GoK) is more progressive in its attitude towards IT, actively encouraging the continued growth of the industry through national initiatives such as Vision 2030, ICT Master Plan, and the recent deployment of a nationwide fibre optic network infrastructure (MICT, 2017).

The Kenya ICT National Master Plan provides a mechanism for developing and sustaining high-end talent by aiming to remove the skills gap between industry requirements and the capabilities for the local workforce. Some of these requirements include reducing the need for foreign expertise in ICT projects, retaining current high-end talent, and ensuring effective skills transfer and training (MICT, 2017).

The IT policy and regulatory landscape is nascent, with few regulations in place. However, GoK recently developed a National Cyber Security Strategy, which includes four strategic goals (MICT, 2014):

1. Enhance the nation's cyber security posture in a manner that facilitates the country's growth, safety, and prosperity.
2. Build national capability by raising cybersecurity awareness and developing Kenya's workforce to address cybersecurity needs.
3. Foster information sharing and collaboration among relevant stakeholders to facilitate an information sharing environment focused on achieving the Strategy's goals and objectives.
4. Provide national leadership by defining the national cybersecurity vision, goals, and objectives and coordinating cybersecurity initiatives at the national level.

Another significant policy is the European Union's (EU) General Data Protection Regulations (GDPR). This new set of privacy regulations is designed to protect the data privacy rights of European residents. However, the regulations apply not only to EU-based organisations, but also to those located outside the EU if they collect or process the personal data of EU residents. As a result, many Kenyan companies must adhere to the regulations, including mobile and internet service providers, airlines, media houses, banks, and insurance companies.

GoK is currently developing a policy and regulatory framework for privacy and data protection by collecting views from the private sector, civil rights organisations, and members of the public. According to the Data Protection Bill 2018, companies will have to inform users of any personal data they are collecting, the purpose for its collection, and for how long it will be stored. The law also gives users the right to decline to have their data collected or processed, and to demand that false data be corrected or deleted (Standard Media, 2018).

With GDPR in place and the incoming Data Protection law in Kenya, companies will be expected to enforce data protection policies and regulations to avoid penalties. For some, it will necessitate investment in cyber-security specialists, compliance professionals, and data protection officers.

Though GoK is making encouraging strides in IT policy, there remains considerable scope for improvement. One example is in capacity building; one knowledgeable interviewee highlighted the disintegration of a partnership with IBM following a change in government.

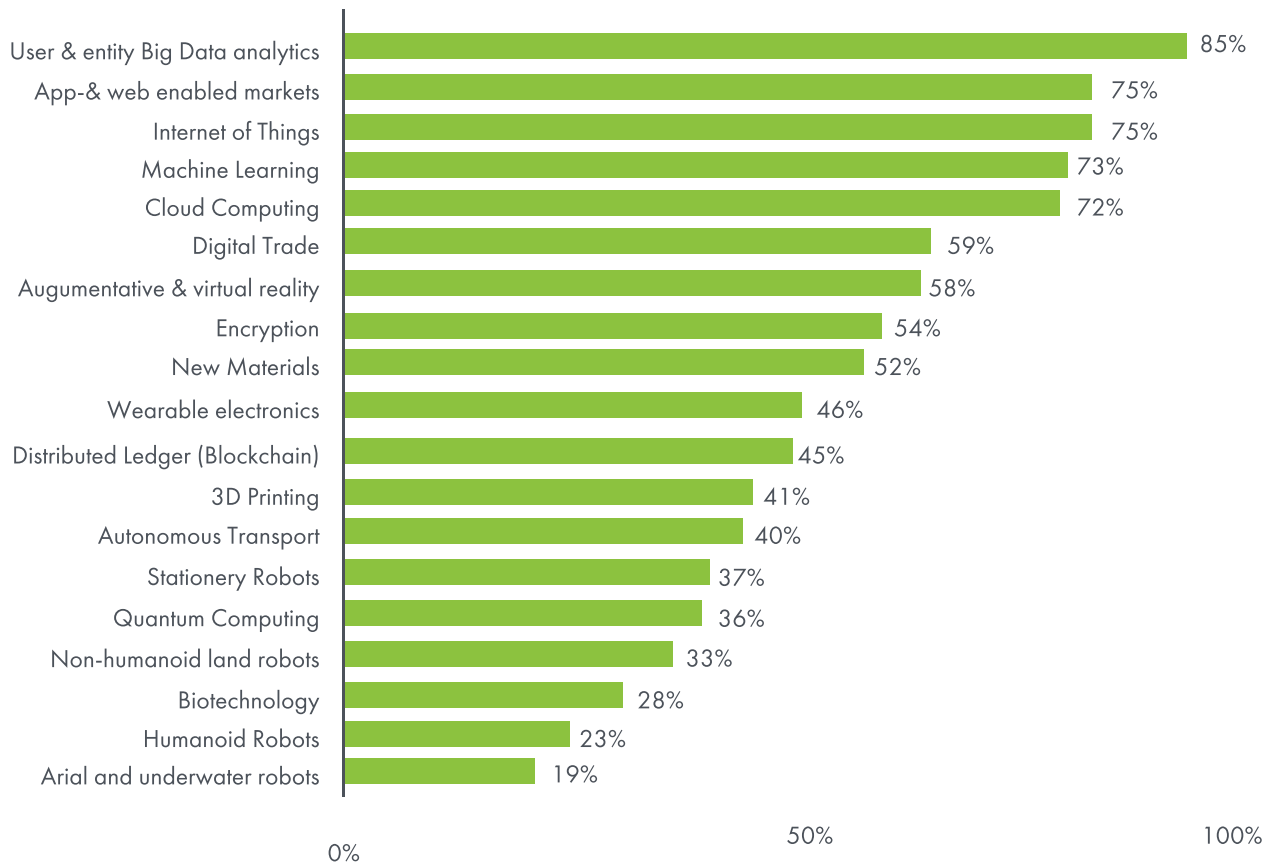
This partnership had involved IBM training five Kenyans in its global labs, before deploying them in Kenya once they had acquired relevant skills. However, now that the partnership has ended, the program is no longer open to further candidates and the government does not have a share in the 42 patents secured by IBM in Kenya.

The WEF Future of Jobs 2018 report surveyed global employers, collectively representing more than 15 million employees. It details four specific technology advances that are expected to dominate the 2018-2022 period as drivers affecting business growth positively: ubiquitous high-speed mobile internet, artificial intelligence, widespread adoption of big data analytics, and cloud technology. 85% of respondents said that they are likely or very likely to have expanded their adoption of user and entity big data analytics by 2022.

3.1.5 The Future of Jobs and Skills in Kenya

Similarly, between 72% and 75% of companies are likely or very likely to have expanded their adoption of technologies such as the internet of things and app- and web-enabled markets, and to make extensive use of machine learning and cloud computing (World Economic Forum, 2018).

Figure 15: Technologies by proportion of companies likely to adopt them by 2022 (projected)



Source: *Future of Jobs Survey 2018, World Economic Forum*

With increasing internet connectivity, Kenyan businesses' needs will likely follow these global trends, veering towards emerging technologies such as cloud-based solutions, big data, IoT and AI. However, this leaves the threat of an exacerbated skills gap in these more advanced technologies, particularly given that many non-IT companies do not yet understand IT basics.

This is apparent even now - one expert mentioned that he sees several AI jobs advertised, but few Kenyans with the right skills to fill these roles. Instead, they tend to be taken by Americans. There are similar trends in blockchain, gaming, and big data.

Beyond these emerging technologies, demand for IT skills is shaped by industry trends. Immediate demand centres around software development and networking, given that mobile app development is on the rise; indeed, this should increase with further digitisation across the continent.

It was also apparent that web-apps and thus web developers remain in demand, and that due to the perseverance of basic phones, USSD development will be required beyond the next five years. Although unusual in the global context, it highlights that skills education must remain cognisant of the local context. Some respondents drew attention to the excitement over buzzwords such as block-chain, which has led to many seeking training for jobs which do not yet exist in Kenya.

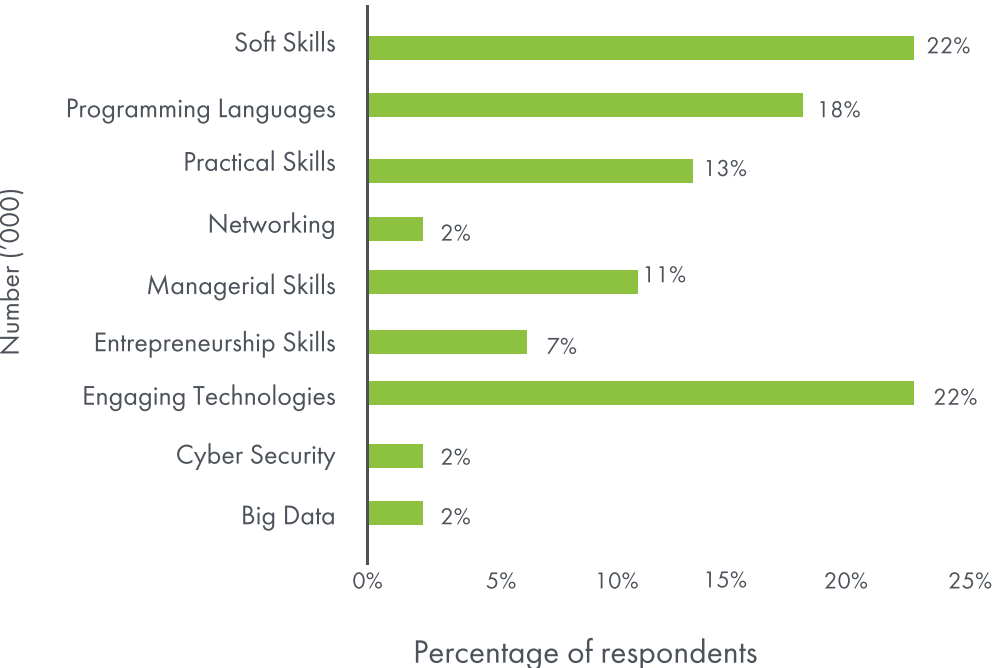
In terms of adoption, SMEs and start-ups are more willing to adopt emerging technologies and incorporate them as part of their business models. On the other hand, non-telecommunications and non-finance industry players still do not see innovation as important in their business models, “given that they want to wait for someone else to come up with a tested solution,” according to one respondent with insight into the situation.

A stakeholder who sells cloud technologies to clients noted that senior management is less willing to take in new technology such as his given that “they do not know what they do not know”. Another noted that most emerging technologies currently sit within large MNCs, since they have the capacity to invest in them, but are not well-developed outside these corporations.

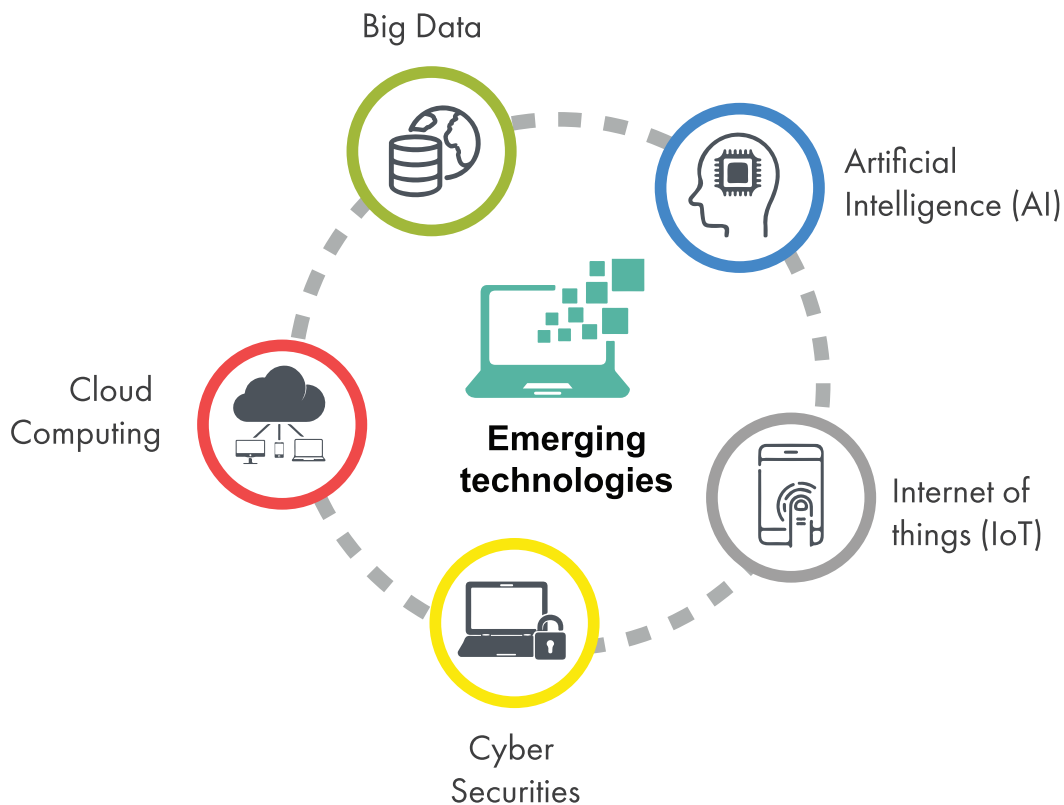
When asked what skills they anticipate needing to achieve their career goals in the next 5 years, many survey respondents (22%) indicated an interest in acquiring emerging technology-related skills including machine learning and AI, cyber security, robotics, business intelligence, big data, data analysis, IoT, and cloud computing. Notably, emerging technologies tied with soft skills at 22%.

Figure 16: Future Outlook on Skills

The majority of IT professionals are interested in acquiring soft skills and emerging technologies.



Emerging technologies



These emerging technologies entail a number of different roles and skill-sets. Overviews of each are provided below:

1. Big Data

Big Data is used to describe immense volumes of data, both unstructured and structured. However, given that size is relative, there are other markers that are used to distinguish between big data and traditional data - for example, big data has highly scalable analytics processes through which the amount of data that can be analysed is effectively unlimited. Big data is also flexible; whereas traditional data is stored in specific types of databases employing consistent data structures, big data datasets can come in various forms, enabling the analysis of unstructured data. Unlike traditional data, it allows for real-time results, and has machine learning applications. Data scientists deal with both structured and unstructured data. They use a combination of statistics, mathematics, program

ming, and problem-solving in order to capture, interpret and use data in innovative ways without the use of pre-established templates. Data analysts, on the other hand, examine raw data with the purpose of drawing conclusions about that information, typically relying on existing templates and methodologies. Data analysts and data scientists are both in growing global demand, as identified by the WEF Future of Jobs 2018 report.

Within Kenya, companies are only just beginning to understand the importance of data as it pertains to their business model; many do not yet recognise its full potential. As awareness increases, there is likely to be a correspondingly higher demand for data analysts and scientists, who are already in short supply.

According to the Stack Off 2017 report, few developers in Kenya have delved into the data space, with less than 25% of the 500+ developers surveyed having encountered these disciplines. Of those that did, Tensorflow, Matlab and Hadoop were among the more popular tools in use. Among experienced developers, additional tools that featured were SAS, Tableau, Apache Spark and Cassandra.

The following table outlines key skills and jobs under the umbrella of Big Data:

Table 3: Key skills and Jobs under Big Data

Skills	Jobs
<ul style="list-style-type: none"> • Apache Hadoop • NoSQL databases • Data visualisation • Machine learning • Apache Spark • Quantitative Analysis i.e. expertise in R, SAS, Matlab, or Stata • General Purpose Programming Languages including Java, Python, C, Scala, etc • Data mining • Problem solving • SQL 	<p>Data analyst</p> <ul style="list-style-type: none"> • Database administrator • Data scientist • Data architect • Database manager • Data engineer

2. Artificial Intelligence (AI)

AI is expected to create 2.3 million jobs by 2020, replacing the 1.8 million it will eliminate, according to a Gartner report. The Upwork Skills Index Q1 2018 report states there has been an increasing demand for AI-related skills including computer vision (#8), augmented reality (#10), and chatbot development (#11). This suggests that companies are embracing independent talent to find new and emerging skills, while freelancers are also preparing themselves for a future where old jobs are becoming obsolete and innovation is progressing faster than ever (Upwork, 2018). Several experts highlighted AI as the number one emerging trend to influence the Kenyan IT industry in the short to medium term.

Table 4: Key Skills for Select AI Jobs

Select Key Skills for AI Jobs	AI Jobs
<ul style="list-style-type: none"> • Machine learning • Python • R • Data science • Hadoop • Big data • Java • Data mining • Spark • SAS 	<ul style="list-style-type: none"> • Data scientist • Software engineer • Machine learning engineer • Software architect • Data analyst • Data warehouse engineer • Full stack developer • Research scientist • Front-end developer • Product manager

3. Internet of Things (IoT)

IoT is among the top three technologies that most stakeholders cited as a “must watch” over the next 5-10 years. Even though C was not cited as a popular programming language among respondents, it is a critical language for IoT, and its knowledge is a fundamental requirement for anyone working on IoT projects.

This contradiction between recognizing the importance of IoT but not the programming language C may be due to that fact that the majority of Kenyans do not yet understand applications related to IoT, with one expert stating, “People understand just one application, but not anything else.” An employer who runs a fintech start-up said that he will shortly be looking for employees with IoT and AI skills; such demands will likely become more common over the next 5-10 years. As companies move towards incorporating IoT into their business models, it is important for the next generation of software developers to be more than coders. IoTify (2018) highlight the following skills needed for an IoT developer:

Table 5: Internet of Things (IoT) Skills

IoT Skills
<ul style="list-style-type: none">• Machine learning and AI i.e. Machine Learning, Deep Learning, AI, Neural Networks, TensorFlow• Design for data i.e. Big Data, MongoDB, Apache Cassandra, Spark, Elastic Stack• Automation i.e. Test Automation, Unit Test, CPPUnit, JUnit, SOAPUI, Mocha, Regression, JMeter• IP networking i.e. Routing, Switching, VPN, MQTT, CoAP, AMQP, HTTP, SSL, DTLS, HTTPS, Nginx, Mosquitto, Load Balancing• Hardware interfacing i.e., Raspberry Pi, Arduino, GPIO, USB, I2C, LEDs, FPGA, ASICs, SoC, Bluetooth, LoRaWAN, Micro-controllers, ARM Cortex• Mobile development i.e. Android, iOS, Cordova, Meteor, BLE, Java• UI/UX design i.e. Mobile UI, UX vs UI, Material design, Angular2, Front End, Javascript, CSS, Bootstrap, Basic colors• Information security i.e. Cryptography, Authentication, Non-repudiation, Encryption, Ciphers, Public Key Infrastructure, Elliptical Curve Cryptography, AES, RSA, SSL, TLS, DTLS and VPN etc• Business intelligence i.e. Streaming Analytics, Predictive Analytics, Hadoop, PowerBI, Tableau, Machine learning, Elastic Stack• Teamwork i.e. Teamwork, Agile, Scrum, HW-SW codesign

4. Cyber Security

As the frequency and severity of cyber-attacks continue to rise, organizations are coming face-to-face with the looming danger of a data breach. There is a need to have people within companies who have the ability to create and implement cyber security strategies and policies that align with the company’s IT policies. The Enterprise ICT Survey Report by the Communications Authority and the Kenya National Bureau of Statistics (2016) indicated that the proportion of businesses with an ICT security policy increased with the size of the enterprise. 70.2% of large businesses had a security policy, compared to 21.5% of micro enterprises. With global and local data protection policies also in place, there will be a growing demand for people with cyber security skills.

Table 6: Cyber Security Skills

Cyber Security Skills	
•	IoT security
•	Vulnerability assessments
•	AI and machine learning
•	Cloud security
•	Malware protection

5. Cloud Technologies

Several stakeholders identified cloud computing as a notable emerging technology that merits attention. For organizations across the globe, cloud computing offers massive benefits, such as scalable storage, better collaboration, and lower costs. The biggest obstacles which have prevented mainstream cloud uptake in Kenya - slow internet access, expensive data, and unreliable connectivity - are being improved rapidly, paving the way for mass adoption of cloud-based computing (Business Daily, 2017).

According to the Enterprise ICT Survey Report 2016, 35.6% of Kenyan public sector institutions use cloud services in comparison to only 22.9% of private businesses. This trend is largely due to a government strategy to digitize services across the public sector. Among those firms that had not yet deployed cloud computing, 39.8% were at the stage of developing it. However, though growth is accelerating, the majority of businesses and public institutions remain off the cloud. Large firms expressed security concerns as one of the main reasons for not deploying cloud services, while 42.4% of micro enterprises cited as a major hindrance insufficient knowledge about cloud services within the organization. Other concerns included high costs, a poor regulatory framework, under-development, insufficient technical capacity, and corporate policy.

Overall there is a need for people with cloud computing skills to match the growing demand in cloud computing services in Kenyan companies.

Table 7: Cloud Computing Skills

Cloud Computing Skills	
•	Database skills
•	Programming skills i.e. Perl, Python, Ruby
•	Linux
•	Devops
•	Quality assurance
•	Information security

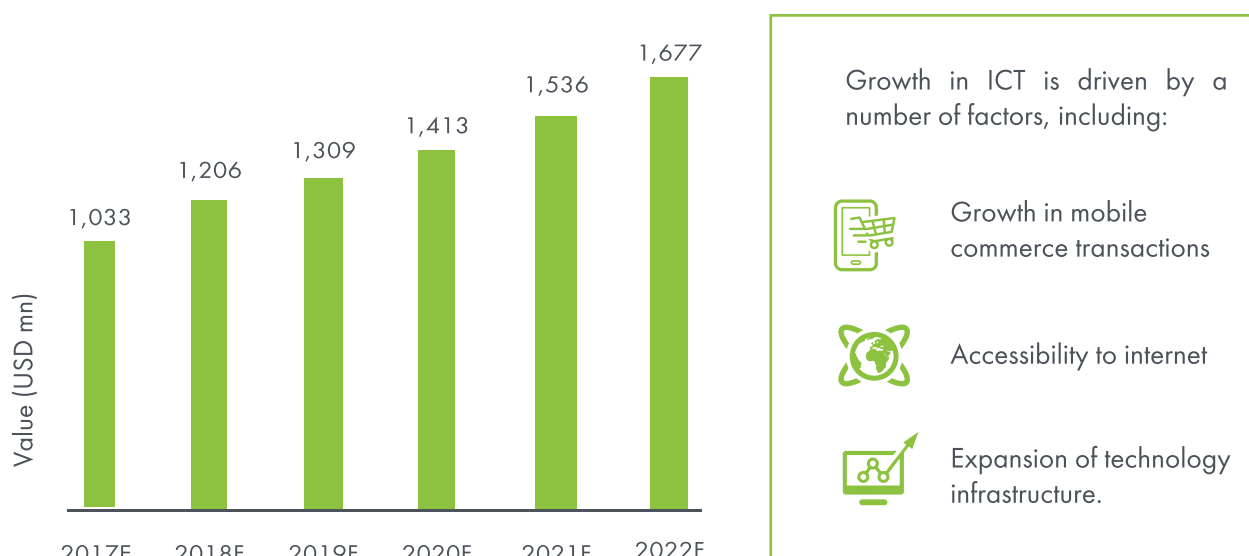
3.1.6 Market Forecasting

Our research revealed that Kenya's IT industry is relatively under-documented. As a result, there is a relative dearth of data to feed into a predictive analysis around future trends for the industry. That said, based on our analysis of existing data, including relevant publications and information gathered through stakeholder interviews, we forecast the following scenario for the future of Kenya's IT industry:

3.1.6.1 ICT industry value¹

The ICT industry in Kenya is estimated to be between 1.20% and 1.40% of GDP. Based on the 2017 Kenya National Bureau of Statistics Economic Survey (2018), the ICT sector contributed 1.30% to the national GDP in 2017, amounting to US\$1.0 billion. Using the average of the preceding 5 years and assuming a constant growth rate, the sector is expected to contribute 1.37% to GDP by 2022. This will place the value of the ICT industry at US\$1.7 billion in 2022.

Figure 17: Kenya ICT Industry Value, 2017-2022



Source: Kenya National Bureau of Statistics and Botho Analytics

3.1.6.2 Higher Education for Technology² market value

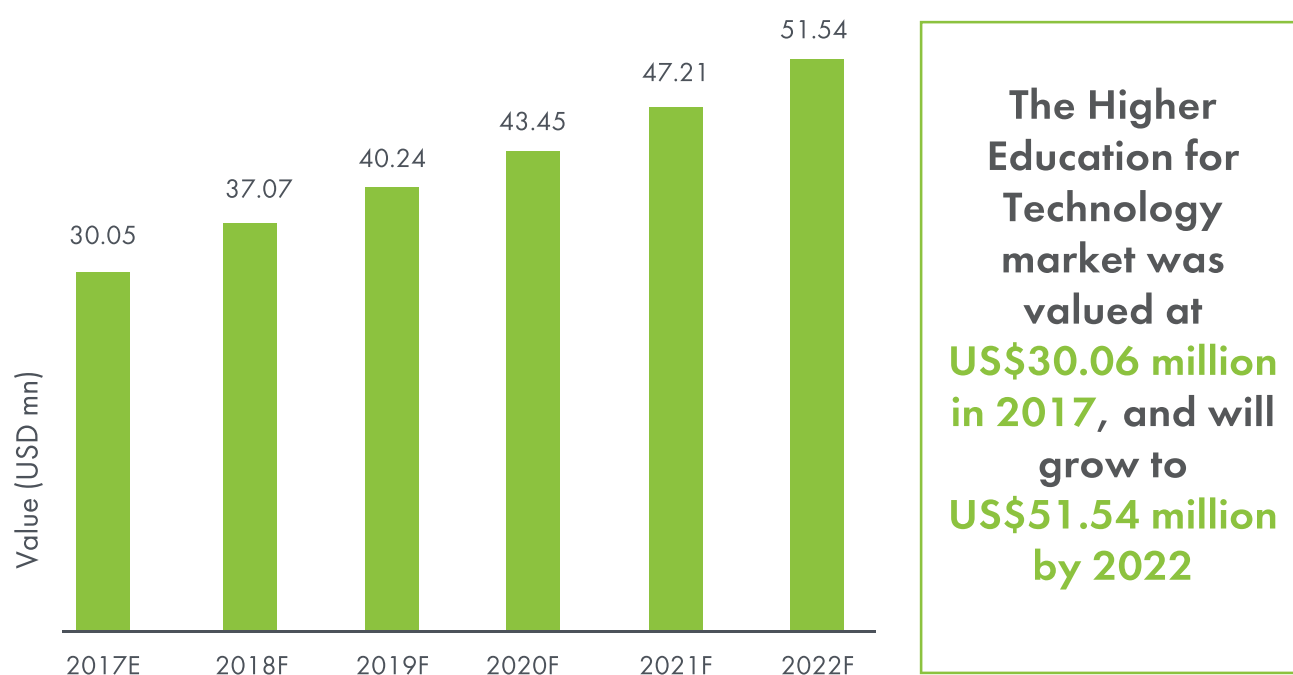
According to the 2016 State of University Education in Kenya Report (Commission for University Education, 2016), the percentage of students enrolled in ICT courses is 4.2% of the total enrolment in Higher Education Institutions. On this basis, we assume that the Higher Education for Technology market value in Kenya is 4.2% of the Higher Education industry value. Using this percentage, we estimate that the Higher Education for Technology market was valued at US\$30.06 million in 2017, and that it will be valued at US\$51.54 million by

1. ICT here refers to the Information, Communications and Technology Industry. It includes individuals who have specialized in Computing and Information Sciences. In this report, the ICT industry will refer to all operations relating to Computing, Technology and Information Services.
2. Refers to technology-related skills development in higher education, specifically, technology and computing courses within the Higher Education Institution (HEI) context.

2022, assuming the growth rate remains constant. More generally, reports show that the global EdTech Market is expected to grow by 17% on a year-to-year basis, reaching US\$252 billion by 2020 (Seedstars, 2018). The African market, which has been termed as the most dynamic, is expected to be valued at more than US\$758 million in 2018. This market is led by Senegal, Zambia, and Kenya (PR Newswire, 2016).

Figure 18: Kenya Higher Education for Technology Market Value, 2017-2022

Kenya ICT Industry Value 2017 - 2022 (USD mn)



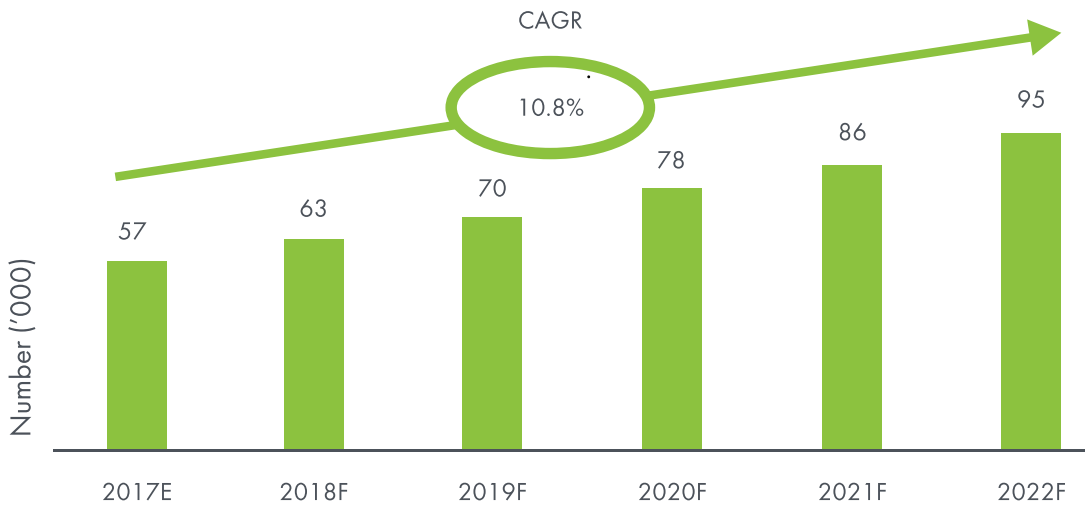
Source: Kenya National Bureau of Statistics and Botho Analytics.

3.1.6.3 Projected IT Employment

According to the International Data Corporation (2016), total IT employment was estimated to comprise 27,000 IT professionals in 2010. In the same report, it was projected that over the five years leading to 2015, the total IT workforce would grow at a CAGR (compounded annual growth rate) of 10.8%, reaching 47,000 employees in 2015. Using the same growth assumptions, we estimate that at the end of 2017 there were 57,000 IT professionals in employment. We project that this number will grow to 95,000 employees by the end of 2022, driven by increased investment in IT services by companies and demand for high-end IT skill sets such as project management, data science, and software engineering.

Figure 19: Projected IT Employment in Kenya, 2017-2022

Project IT Employment in Kenya 2017 - 2022 ('000)



Source: IDC, 2011 & Botho Analytics

While we have been able to estimate the total projected IT employment, which implies how many positions will be filled, there is a lack of data on the number of unfilled positions. Without this information, it is not possible to capture the full extent of demand within the industry; thus, it is not possible to draw accurate quantitative conclusions about the state of demand relative to supply.

3.1.6.4 Projected IT Graduates

According to the 2016 State of University Education in Kenya Report (Commission for University Education, 2016), 71,338 students graduated from Higher Education Institutions (HEIs) in 2015. The report estimated that graduation numbers will continue to grow at a CAGR of 24.64%, reaching 100,839 students in 2017. We estimate that of these, 5,874 students graduated with computing qualifications in 2017, which reflects the historical percentage of computing graduates to total graduates of 5.3%.

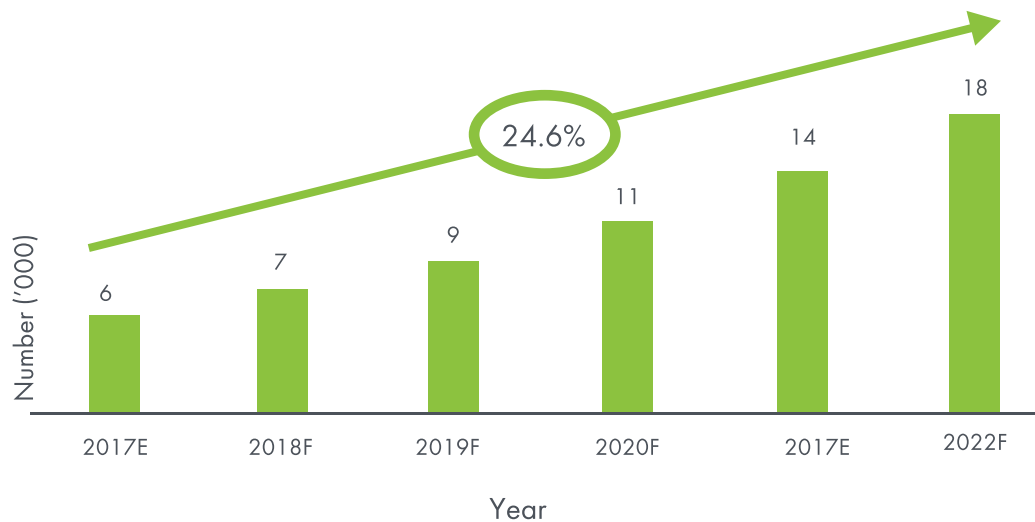
+100,839
Students graduated from Higher Education Institutions (HEIs) in 2015 and it's estimated that graduation numbers will continue to grow at a CAGR of 24.64%

5.8+%
Students graduated with computing qualifications in 2017, which reflects the historical percentage of computing graduates

By 2022, this number is projected to grow to 17,671 students. As a point of comparison, it is estimated that there were 112,875 computer and information sciences graduates from all accredited post-secondary training institutions in South Africa in 2016 (Statistics South Africa, 2017 via www.businessstech.co.za).

Figure 20: Projected IT Graduates in Kenya, 2017-2022

Projected IT Graduates in Kenya 2017 - 2022 ('000)



Source: State of University Education in Kenya Report & Botho Analytics



Developers are in highest demand; more than 50% of all IT-related job postings reviewed were searching for developers.

We estimate that the number of IT professionals in employment currently outstrips supply of IT professionals from HEIs, and will continue to do so during the forecast period in Kenya.

Moreover, the quality of supply fails to meet the standards demanded by the market. This was confirmed by most of the employers that were interviewed.

3.1.7 Summary of Jobs Board & Survey Data

3.1.7.1 Job Board Analysis

Based on analysis of 7 job boards (BrighterMonday, Career point, iHub, Jobweb, LinkedIn, Myjobmag and Timesjobs), looking at a total of 179 jobs, the following are identified trends around job postings for IT-related positions:



- Developers are in highest demand, with more than 50% of all IT-related job postings in search for developers.
- IT Admins are second in skills demand, at 18% of all IT-related job postings.
- Senior managers in IT are third in demand, at 11% of all IT-related job postings.
- 4% of all IT-related job postings are data and business intelligence related roles.
- More than 50% of all IT-related postings are looking for mid-level applicants with 2-5 years of experience. 28% of jobs have not specified their experience requirements. 18% of jobs are looking for senior-level applicants, with only 2% of jobs at entry-level.
- The IT industry is in most need of IT-related skills, accounting for 34% of all IT-related jobs posted, followed by consultancy at 16%, and the banking, finance and insurance industry at 11%.

3.1.7.2 Survey Analysis

According to our survey for IT Professionals/Entrepreneurs, the following are findings from the 47 respondents:

- Javascript (25%), Python (24%), Java (18%), and PHP (13%) are the top 4 programming languages in which IT professionals are proficient.
- 72% of surveyed IT professionals are proficient in 2-4 programming languages. 23% of IT professionals are proficient in 1 language, and only 5% of the surveyed IT professionals are proficient in more than 5 languages.
- Half the respondents shared that they were interested in senior management positions in the next 5 years. This was followed by entrepreneurship, at 26%.
- The majority (82%) of IT professionals are proficient in software development. Data analytics and cyber security follow at 9% each.
- Many survey respondents (27%) indicated an interest in acquiring emerging technology-related skills including machine learning and AI, cyber security, robotics, business intelligence, big data, data analysis, IoT, and cloud computing. Notably, emerging technologies was followed by soft skills at 22%.



The number of IT professionals in employment currently outstrips supply of IT professionals in higher education institutions and will continue to do so in the next five years. Moreover, the quality of supply fails to meet the standards demanded by the market

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3.2 UGANDA

3.2.1 General Overview

Official youth unemployment (ages 15 to 24) in Uganda stands at 2.9% as of 2017 (World Bank). While this is considerably lower than in Kenya, where the youth unemployment rate exceeds 26% (World Bank), it is estimated that more than 40,000 young people graduate from Ugandan universities each year, yet the market can provide only 8,000 jobs annually (The Guardian, 2014). Uganda, just like most African countries, is expected to have a youth bulge that will further exacerbate the youth unemployment challenge. This problem will be even harder to solve given the general skills gap in the country.

The Ugandan IT sector share of national GDP in 2014 stood at 6%, employing 1 million people. It is currently one of Uganda's fastest-growing sectors, recording double-digit growth. The telecommunication industry has driven this growth, where increased investment has resulted in Uganda being one of the few countries with 100% GSM coverage and a cellular penetration of over 95% (International Trade Centre, 2016).

Though statistics on job figures within the IT sector are not readily available, discussions with employers suggest that demand for competent IT professionals currently outweighs the supply. Every employer interviewed commented that they struggle to find suitable employees locally. Our interviews and surveys attempt to identify why this is the case, which skills are lacking, and how training institutes are and could be rectifying this situation.

Due to the lack of skilled IT professionals locally, many employers seek to outsource work abroad. A few trends can be identified:

1. Newly arrived foreign companies tend to be uneasy with local hires at first, but soon adapt.
2. Temporary foreign consultants too often fail to pass on knowledge, requiring operational support to be outsourced.
3. Start-ups usually do not have the cash to afford greater experience than what is available locally.

3.2.2 IT Skills & Jobs Supply

3.2.2.1 Skills Development

Advanced IT skills development in Kampala is offered in both traditional and non-traditional institutions. Interviews suggest that traditional institutions such as universities do not offer IT skills that match market needs. This gap is filled by non-traditional institutions such as hubs, complementary programs, and online platforms. This section examines the various institutions in Kampala that offer IT skills development



Universities



Hubs



Complementary Programs



Online Platforms

1. Universities

There are several universities offering IT-related undergraduate, postgraduate, and diploma programs in Kampala and beyond. These include Mukono, ISBAT University, and technical institutes such as the Uganda Institute of Information & Communications Technology. Interviews suggested that collectively there are over 5,000 IT-related university graduates each year, and many more learning similar skills through degrees such as Electrical Engineering.

The most prominent university in Uganda is Makerere. Makerere has arguably the best reputation, highest number of students, and a strong research function supported by grants from and partnerships with international players such as Gates Foundation and Google. Makerere University hosts an AI & Data Science Lab, which has made innovations in the area of AI, but at a small scale.

Figure 21: Case Study - Makerere University

Makerere University: Artificial Intelligence & Data Science Lab

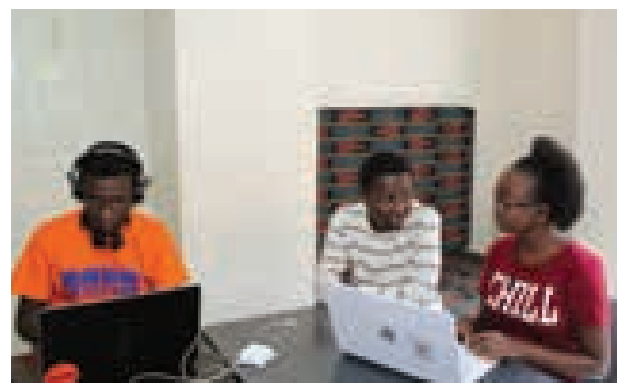
The AI & Data Science research group at Makerere University specialises in the application of artificial intelligence and data science — including, for example, methods from machine learning, computer vision and predictive analytics — to problems in the developing world. Based in Makerere University’s College of Computing and Information Sciences, the lab has around 15 researchers, and active collaborations with universities and organizations across the world.

Some of the research that has been carried out in the lab includes:

- Automated diagnosis of both crop and human diseases
- Auction design for mobile commodity markets
- Analysis of traffic patterns in African cities
- Use of telecoms and remote sensing data for anticipating the spread of infectious disease

Curriculum Disconnect

The Makerere curriculum changes every five years; a one-year review is held after every four years. The curriculum change in the graduate school is mandatory and needs to be done as per the Government of Uganda’s mandate. This is done in conjunction with private sector input and must be approved by the National Education Board. Makerere tries to cover new ideas through modules such as “Emerging Trends”, which addresses technologies such as blockchain, data science, AI, and cloud computing. To ensure that students are receiving the right skills, Makerere University recently merged two different undergraduate departments to create a Bachelor of Information Systems and Technology (BIST), where students take all the mandatory courses in their first year and a specialization route in their second year.



However, a consistent complaint throughout graduate and employer interviews is that most of the higher education institutions in Kampala offer curricula that do not match the requirements of the market, variously described as too “outdated”, “modular”, “shallow”, and “basic”. Ultimately, technology and the associated skills demanded by the market evolve too quickly for a long-term university curriculum to remain entirely relevant; there is no way that even year-long courses, let alone undergraduate degrees, can keep up. Furthermore, “Emerging Trends” modules are too brief to offer genuinely profound opportunities for learning. University lecturers and administrators acknowledge that there is a challenge, but point out that they are not purely vocational institutions; they cannot focus predominantly on practice and ignore theory. One interviewed professor mentioned that the Makerere University curriculum begins with an emphasis on theory, with more practical content introduced gradually.

Additionally, employers complained that most tertiary institutions do not teach students soft skills, meaning they lack critical skills such as problem solving, critical thinking and teamwork, all of which are vital to ensure they are competitive in the IT industry and overall job market.

Theory vs. Practice

The inability of the curriculum to keep up with emerging technology is compounded by it being too theoretical, lacking in practical coursework and experimentation. This was a unanimous complaint by both graduates and employers. Those students who have not pursued practical projects in their spare time struggle to find employment; in contrast, those who have are in high demand.

In response to this, Makerere has begun to include some practical elements in their coursework, for instance through internships for undergraduates in their second and third years. Nonetheless, these are deemed to be insufficient by graduates and employers.

It is unlikely that Makerere’s approach towards both the content and updating of its curriculum will change. Since it is a university, Makerere does not consider itself a purely vocational institution, and, therefore, values theoretical content. Furthermore, the process behind curriculum development is entrenched, and even if modified will still struggle to keep pace with rapidly evolving demand. Consequently, a gap between university training and market demand will likely persevere.

2. Hubs

Uganda has close to 20 hubs and co-working spaces. Most of these hubs are based in Kampala, which act as accelerators and incubators for IT start-ups. Interviews suggested that students were able to benefit from these hubs, which serve as both co-working spaces and tech communities offering learning platforms and opportunities to build IT skills. They include, among others:



Innovation Village

Innovation Village is both an accelerator and an incubator that is trying to address: inadequate policy around entrepreneurship and innovation; lack of technology and talent; a market that does not understand what it wants; and the lack of capital for start-ups. It works alongside different stakeholders in Uganda's start-up ecosystem including universities, the private sector, and government.

Modelled around problem-solving entrepreneurship, it offers human-centred design projects such as Hack for Refugees, where in partnership with UNCDF, DanChurchAid and Mercy Corps, entrepreneurs were immersed within the refugee community to co-create feasible solutions with refugees before prototyping and testing their solutions over a 3-month period; 8 start-ups were selected to work with different partners to scale up their ideas. Innovation Village also offers capacity building through the International Trade Centre (ITC), where they upskill entrepreneurs through different support and training programs.



Designhub

Designhub is a co-working space where different people - entrepreneurs, freelancers, designers, writers, product developers, marketing minds, and tech start-ups - can feel comfortable working on their own projects, while having the possibility of sharing, engaging and creating with others. Designhub's goal is to create economic value with the many creative skills that are already available in Uganda through design thinking, and to facilitate knowledge exchange in the co-working space. Designhub mainly focuses on design and cybersecurity. Tunga, a company that promotes Ugandan software developers on the international market, is directly connected to Designhub.



Outbox

Outbox helps new and upcoming African technology entrepreneurs with workspace, business incubation and technical training programs. It runs hackathons, boot camps, and events aimed at building the IT skills needed for entrepreneurs to develop their own businesses or to succeed in the workplace.



Venture Labs East Africa

Venture Labs East Africa provides researchers, entrepreneurs, developers and investors with a field-based platform to explore and incubate ambitious venture concepts. Their aim is to de-risk the development of the highest potential opportunities and create the foremost investment vehicle for East African innovation.



Pulse Lab Kampala

Pulse Lab Kampala is a data innovation lab run by UN Global Pulse, established as an inter-agency initiative under the management of the UN Resident Coordinator in Uganda. It allows data scientists, data engineers, partnerships specialists, academics and technologists to sit side-by-side with policy-makers and development practitioners to collaborate on projects and prototypes, leveraging innovative solutions to address development challenges. It has three primary objectives: to achieve a critical mass of implemented data innovations; to lower barriers to adoption and scaling; and to strengthen the big data innovation ecosystem.

Since its opening in 2015, Pulse Lab Kampala has collaborated with academic groups in Africa aimed at applying data science to address humanitarian and development challenges. The government is currently building an incubation centre to house three ITES service providers, employing up to 240 agents. Its success will likely depend on the partner brought in to run operations; the government is looking abroad.

Uganda has approximately 20 hubs and co-working spaces. Most of these hubs are based in Kampala, and act as accelerators and incubators for IT start-ups.



3. Complementary Programs

There are several specialist commercial IT providers based in Kampala, divided between those offering longer-term (i.e. more than one year) programs, and shorter-term courses.

The most prominent longer-term provider is Andela, where the program lasts for four years but with an evolving curriculum. There are around 6 cohorts per year, each of about 10 students. During this period, students are provided with a laptop, food, and internet free of charge. There are no fees to be paid unless a student fails to complete the program. In return, Andela provides students with opportunities to work on their existing projects.

This structure - particularly the practical content - ensures that there is a strong contrast to the theoretical content offered by university courses. The course content is highly regarded, and interviewed employers stated that graduates are competent and sought after. A major challenge is to retain senior developers, since trained Ugandans follow higher paid jobs often offered by newly arrived international companies.

The two more prominent commercial institutions offering short courses mentioned by respondents were AP Tech and the Ugandan franchise of the multi-national, US-headquartered New Horizons. These offer a wide range of training programs and certifications, usually undertaken on a part-time basis. As an example, AP Tech offers five software engineering and five multimedia courses, twelve professional certification courses, and five shorter term specialist courses.

In addition to these, Kampala has institutions catering to more specialist interests, such as the Artfield School, which focuses on animation (two years, total cost UGX 1.8M / US\$470).

4. Online Platforms

Interviews suggested that it is common for Ugandans to take online IT courses offered by international training and certifications providers. These courses are recognised and valued by employers.

Providers such as Udemy charge, though it was found that many Ugandans will wait to take advantage of discounts offered. As an example, one BA graduate in Information Technology saved 50% when paying \$130 for a course in Digital Marketing, and \$260 for a course in Information Systems and Security. Spending ten hours a week on the courses, they took around six and eight months to complete respectively.

Providers such as Udacity also charge for their courses, but offer refunds should the student fail to secure a job within a given timeframe. Since Udacity is funded by companies looking to hire trained IT personnel, it is extremely rare that these repayments have to be made. It would be hard to develop better content than that offered by the likes of Udemy, Udacity and Coursera, since huge amounts of money have been spent on curriculum development. Students are usually supported by human input throughout, with the courses sufficiently structured that students are genuinely skilled upon completion.

However, these online courses do not offer everything: for example, lacking a curriculum in a class setting, the opportunity to practice on projects relevant to the local context, and sufficient support for those who need more human assistance. These online courses are also topic-specific and do not combine additional areas of support around soft skills development, one-on-one mentorship, or career coaching.

3.2.3 IT Skills & Jobs Demand

Interviews revealed that there is demand for talent at all levels of seniority. However, the extent of this demand was not possible to quantify – merely that current supply does not meet the demand.

There are three main sources of demand. Firstly, established entities, whether public or private, which need a steady flow of IT specialists in a range of roles. These employers claim that often they cannot find enough talent with practical experience locally. In return, many IT professionals complain that these employers focus on white collar experience to the point of exclusion, and so inevitably look abroad. Newly arrived multinationals tend to begin with only a small proportion of locally-sourced IT professionals, often due to their unfamiliarity with existing IT infrastructure, but transition over time; one employer told us that they had moved from a 50/50 split to 80/20 in favour of locals within three years.

Kampala in particular has a thriving start-up community, a large proportion of which is based on new technology. Often founded by IT professionals themselves, these new companies provide the main source of demand for local IT specialists. Their primary challenge is a lack of funding, meaning that they tend to hire based on capability and potential rather than experience; junior developers might be paid between US\$250 and US\$1,000 a month. They don't tend to be too specific in their demands, usually requiring a software developer with the ability to learn.

International freelancing work provides the third main source of demand. It is following completion of this type of work that Ugandan corporates begin to take Ugandan IT professionals seriously, though freelancing income is sufficiently high that experienced freelancers often prefer to remain self-employed; pay can be over US\$2,000 a month. The main avenue through which software development freelancers find work is through the platform Tunga, offering high rates in Euros. Ugandans enjoy a cost advantage over countries such as India; entry level IT salaries in Uganda are US\$320/month, US\$80 lower than India (International Trade Centre, 2016).

3.2.3.1 Skills and Roles

- 48% of all IT-related postings are for IT administration roles in networking, hardware and software maintenance, e.g. Network and System Security Administrator, Database Administrator, NAV System Administrator. The majority of these jobs are looking for mid-level applicants with between 2-5 years of experience. Companies looking for these roles come from diverse industries ranging from government, NGOs, finance, entertainment, energy, airlines, and the education sector.

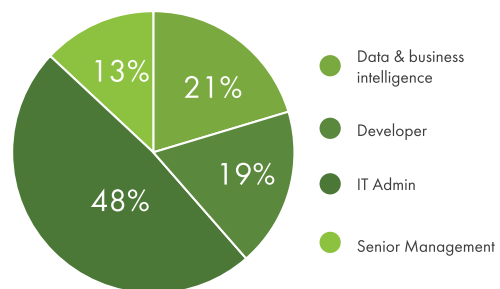
There is solid demand for data-related roles. 21% of all IT-related postings in Kampala are for data

- and business intelligence related roles including data managers, data officers, data administrators, and data analysts. None of the job postings required a data scientist. The majority of these jobs are looking for mid-level applicants with between 2-5 years of experience. The companies looking for these data-related roles come from different industries with a majority in the NGO and research sector, indicating a very different job market structure compared to that of Nairobi.

- 13% of all IT-related postings in Kampala are for developers. There is demand for junior developers with 2-5 years of experience. Some of the roles that were featured include: senior software engineer in mobile and Javascript, junior software engineer in IOS and android, backend developer, applications/software developer. These skills are in demand in companies across different industry verticals including government, health, logistics, and finance.

Figure 22: IT-related job postings by role (Kampala)

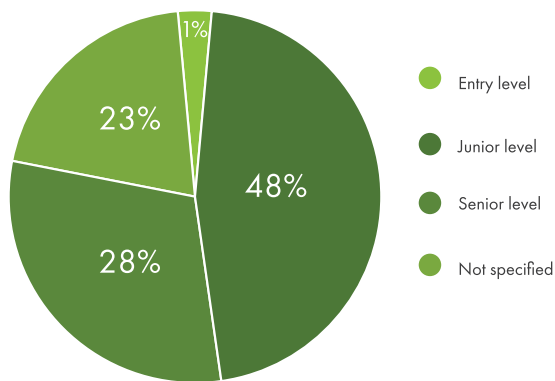
IT-related Job Posting by Role (Kampala)



- 48% of all IT-related postings are looking for mid-level applicants with 2-5 years of experience. 28% of jobs are looking for senior-level applicants, with only 1% of jobs hiring at entry-level. 23% of jobs have not specified their experience requirements.

Figure 23: IT-related job postings by job level (Kampala)(Kampala)

IT-related Job Posting by Job Level (Kampala)



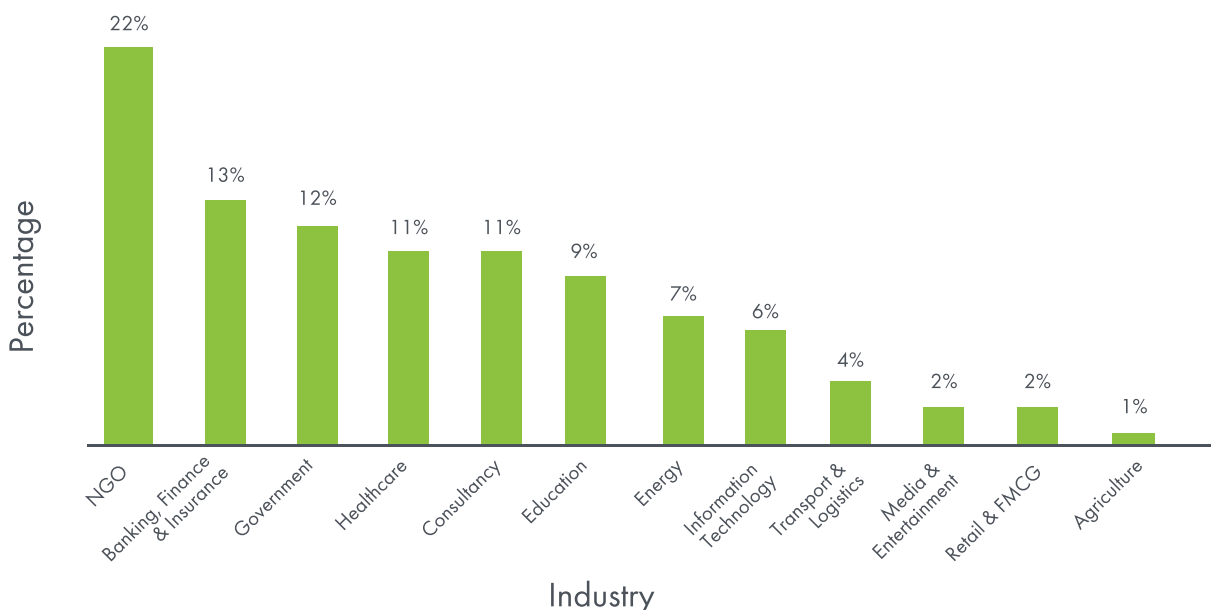
The NGO sector is in most need of IT-related skills, accounting for 22% of all IT-related jobs posted. IT admin roles are in highest demand followed by data and business intelligence-related roles.

The banking, finance and insurance industry is second in demand for IT-related skills at 13%, with the government third. IT admin roles are in highest demand across the two sectors.

Most of the job postings withheld salary information and there is insufficient data to draw conclusions on salaries across different roles and skills levels. Stakeholder interviews corroborated these and additional trends, as follows:

Figure 24: IT-related job postings by industry (Kampala)

IT-related Job Posting by Industry (Kampala)





Training institutes and universities should prioritize inclusion of practical application of skills taught within their programs, and integration of dominant practical modules for any technology-specific course

1. Technical Skills

As mentioned, a consistent and prominent demand from employers is for candidates who have applied their studies in a practical manner and are thus able to contribute without the need for extensive additional training. Training institutes and universities should prioritize within their programs the inclusion of practical application of skills taught, and for any technology-specific course a dominant practical aspect should be incorporated.

Interviews suggested that there is demand not yet met by supply in almost all technical areas and at all levels of seniority. A small number of specific skills which should be targeted was not apparent; instead, there appears to be a general shortcoming across the board. These can be summarized as follows:

- Many older candidates have experience with dated technology more common in banks and telecommunications companies; these skills are rarely of use to start-ups. Nonetheless, experience in proprietary tools such as Oracle and Microsoft and the ability to maintain databases and servers are still needed.
- More basic skills like programming, coding, and app development offer a good grounding for further learning and initial employment. Anecdotally, it seems that many Ugandan companies are having to access developer communities in Kenya and Nigeria for their work.

- Web development technologies such as Python and Django are in demand, for both front and back end development. However, demand for iOS is low.
- Niche areas have a large skills gap: for example, Amazon Works Services, Google Cloud, Quality Assurance, and SAP.

The level of experience required depends on the size of the company; available financial resources dictate how advanced an IT specialist can be hired. There is a shortage of senior developers, and they command high fees as a result; they also have a short-term outlook on jobs. However, enhanced experience tends to come through practical work, rather than additional training.

2. Soft Skills

In contrast, shortcomings in non-technical skills are less generic. Without exception, employers noted and lamented poor soft skills among almost all graduates, reflecting previous studies (BPO Uganda, 2014). Indeed, it was remarked frequently that the skills most deficient in the IT ecosystem have little to do with IT-specific training.

- **Basic communication:** Writing emails and letters, taking and giving calls, face-to-face client interaction, understanding the need for regular interaction with clients.
- **General prioritization:** Work being delivered on time, particularly among freelancers.
- **Problem solving / critical thinking:** The education system does not encourage problem solving, instead focusing on rote and individual learning, and how to pass exams. IT Specialists need to find a way to reach their clients' goals.
- **Basic project management:** Including but not limited to determining what should be prioritized, when, and how.
- **Advanced project management:** Too few people have the technical knowhow and ability to manage larger projects.

Less frequently mentioned but also of interest was the fact that some companies seek IT specialists who can make contributions towards the company that extend beyond IT work, such as writing and editing both IT and non-IT content.

Finally, many IT graduates seek to implement their ideas through establishing their own companies. However, few have had even basic guidance in starting and running a business; many developers have great ideas but struggle to enact them. Regional universities rarely combine technical and soft skills in this manner, with one exception highlighted by respondents: Carnegie Mellon University Africa in Rwanda. Their two Master's programs include soft skills, with immediately evident positive results for companies hiring their graduates. Though the African Leadership University (ALU) Rwanda offers a degree in Computer Science that incorporates soft skills, their first cohort has yet to graduate, meaning the results of their program are not known. While not a direct skill required by employers, one stakeholder mentioned that there was a need for candidates applying for IT job positions to go beyond a CV or LinkedIn, and instead emphasize their portfolio of work through sites such as GitHub. This allows candidates to show how they have applied their studies practically.

3.2.4 Partnerships

The existing disconnect between various stakeholder groups (private sector, academic and training institutions, among others) has already been highlighted at various points in this report. Strategic partnerships can play a significant role in mitigating some of the challenges that result from this existing disconnect. The main sources of demand provide a helpful guide as to which partnerships may be developed and how.

The Government of Uganda is interested in products and e-government services that will improve efficiency. Buy Uganda Build Uganda (BUBU) is a government initiative encouraging Ugandans to create these IT services. A partnership with the government would be a long-term investment, where a likely initial offering would be in supplying developers to build products to solve government problems. Once the relationship is more established, there is an opportunity for the government to offer subsidies to lower the costs of IT skills development programs.

Interviews revealed a growing willingness among established private companies to hire IT specialists based on attitude and potential, before embarking on training programs. Occasionally, IT upskilling through training would be done in-house, but outsourcing this to external training providers would be appealing. Feedback suggested that existing training institutions do not offer adequate courses. Intensive courses on single subjects, rather than multi-subject programs, would satisfy demand more effectively.

Most tech start-ups develop and grow through Kampala's incubators and tech hubs. As such, partnerships between education providers and these hubs would provide opportunities for practical experience and eventual employment for those undertaking training. Finally, the work and financial opportunities available through international freelancing are a big draw to those entering the IT sector; again, effective relationships with freelance platforms such as Tunga should be sought by education providers to create opportunities for graduates.

3.2.5 Market Risks

For institutions beyond universities seeking to address the Ugandan IT skills gap by entering the IT-education market, further major challenges worth highlighting include:

1. Government Relations

Training institutes should be wary of using terms such as 'School' or 'Academy', since this might lead to a need to negotiate not only with the Ministry of ICT, but also the Ministry of Education. The Ministry of Education exhibits an apprehensive approach towards foreign educational establishments following the expulsion of Bridge Academies from the country.

2. Tax / Regulatory Environment

Companies seeking to repatriate money should be aware of withholding tax of 15%. Uganda's social media taxes amount to US\$1.50 per month, restricting the ability of students to use apps such as WhatsApp for study groups. The 1% tax on all mobile money transfers is generally damaging to all businesses.

3. Financing and FX

Course fees and thus income would be denominated in Uganda Shillings, but a significant proportion of costs may be US Dollar denominated. UGX is volatile; the following two-year graph shows fluctuation relative to the US Dollar (XE, 2019).

Figure 25: UGX Fluctuation vs USD, 2017-2018



USD 1 = UGX

3.2.6 The Future of Jobs and Skills in Uganda

Interviews suggested that it is unlikely that there will be drastic changes in either the supply or demand of mid-level IT skills; the current market environment should serve as a guide for the next few years. Based on the aforementioned job posting analysis there is a comparatively high demand (30%) for IT administration roles in networking, hardware and software maintenance, such as Network and System Security Administrator, Database Administrator, NAV System Administrator. There is also significant demand for data-related skills, where 18% of all IT-related postings in Kampala are for data related roles including data managers, data officers, data administrators, data analysts – though no demand for data scientists.

However, demand for advanced skills and emerging technologies is evolving at a faster pace, with a few areas identified as likely to be in greater demand within 2-3 years:

- Machine learning, especially when applied to finance and agriculture.
- Blockchain, which is currently employed by new companies Stellar and eSACCO, with growing interest from banks such as Standard Chartered.
- Cyber security, where those with skills are recruited by banks promptly - even those who have only just left university. Some banks arrange hackathons, and then recruit the best performers.

Several Ugandan companies that were interviewed are already using or plan to incorporate emerging technologies into their business models. One company shared that they are currently using emerging technologies such as machine learning, cloud computing and big data, and plan on extending their digital technologies in the next 2-3 years; AI is likely to become more prominent. However, their main challenge is in recruiting, with very few suitable applicants available in Kampala.

Similarly, another company using big data and IoT to facilitate value-addition of agricultural products from the farm to the market stated that it was difficult to find people with relevant skills in Uganda. This has forced the company to outsource jobs to external service providers.

3.2.7 Market Forecasting

3.2.7.1 ICT industry value

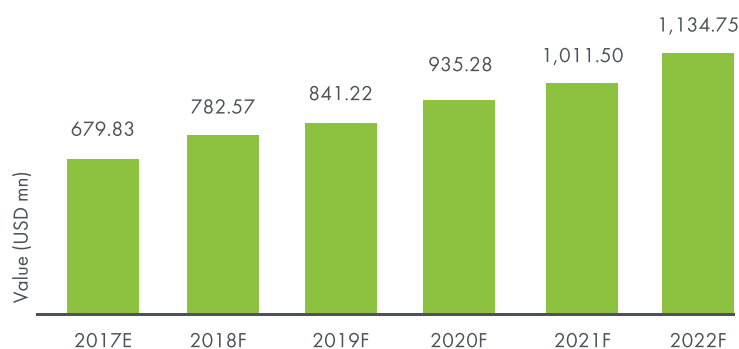
The ICT industry in Uganda accounted for 2.58% of GDP in 2017, based on data from the Uganda Bureau of Statistics (2017). Using the average of the preceding 5 years and assuming a constant growth rate, the ICT sector is expected to contribute 2.83% to GDP by 2022. This will place the ICT industry value at US\$1.13 billion by 2022.

Similarly, another company using big data and IoT to facilitate value-addition of agricultural products from the farm to the market stated that it was difficult to find people with relevant skills in Uganda. This has forced the company to outsource jobs to external service providers.

The ICT sector is expected to grow in value to US\$1.13 billion by 2022 up from 680 Million in 2017, contributing 2.83% to GDP.

Figure 26: Uganda ICT Industry Value, 2017-2022

Uganda ICT Industry Value 2017 - 2022 (USD mn)



Source: Uganda Bureau of Statistics & Botho Analytics.

3.2.7.2 Higher Education for Technology market value

According to Open to Export (2016), an online information service by the UK's Institute of Export & International Trade, the higher education sector contributed US\$40 million to GDP in 2010 and US\$30 million in 2009. Using these values, we estimate Higher Education's contribution to GDP to be 0.2%. Using data on the proportion of the population specialized in Computer and Information Services, we derived a value of 3.83% as the percentage of students within ICT Higher Education. The contribution of Higher Education to GDP is much lower in Uganda than Kenya, 0.2% compared to 1%. Despite this, the market was valued at US\$2.02 million in 2017, and assuming a constant growth rate, is expected to be valued at US\$3.07 million in 2022.

Figure 27: Uganda Higher Education for Technology Market Value, 2017-2022

Uganda Higher Education for Technology market value 2017 - 2022 (USD mn)



Source: Government of Uganda, National Census Statistics & Botho Analytics

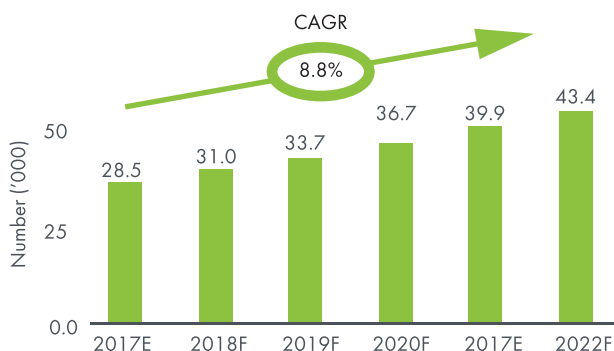
3.2.7.3 Projected IT Employment

Interviews revealed that there is demand for talent at all levels of seniority. However, the extent of this demand was difficult to quantify given lack of current, reliable and industry-specific statistics.

Given the lack of data on IT employment figures for Uganda, a scaling assumption has been used to extrapolate Uganda's skills demand. According to the Kenya National Bureau of Statistics (2016), the total number of employees in the formal sector was 2.6 million in Kenya in 2015. In Uganda, formal sector employees were reported to be 1.3 million in the same year (Uganda Bureau of Statistics, 2016; 2017). Taking the ratio of Uganda's to Kenya's formal sector employment of 0.51:1 for that year, we estimate that the IT workforce was 28,500 employees in 2017. Using Kenya's CAGR of 10.8% and adjusting for Uganda's macroeconomic growth difference to arrive at a growth rate of 8.8%, we forecast that this number will grow to 43,400 employees by the end of 2022.

Figure 28: Projected IT Employment in Uganda, 2017-2022

Project IT Employment in Uganda (2017 - 2022 ('000))



Source: Government of Uganda, National Census Statistics & Botho Analytics

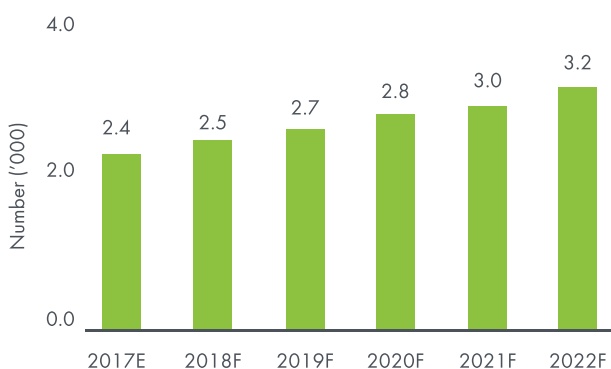
Similar to our analysis for Kenya, while we have been able to estimate the total projected IT employment, which implies how many positions will be filled, there is a lack of data on the number of unfilled positions. Without this information, it is not possible to capture the full extent of demand within the industry; thus, it is not possible to draw accurate quantitative conclusions about the state of demand relative to supply.

3.2.7.4 Projected IT Graduates

Interviews suggested that collectively there are well over 5,000 IT-related university graduates each year in Uganda, and many more learning similar skills through degrees such as Electrical Engineering. In Kenya, the total enrolment in both public and private universities was 539,749 in 2016, as reported by the Commission for University Education (2016) in Kenya, and that of Uganda was 254,043 in 2015/16, according to the Ugandan National Council for Higher Education. It is estimated that more than 40,000 young people graduate from Ugandan universities each year, yet the market can provide only 8,000 jobs annually (The Guardian, 2014).

Figure 29: Projected IT Graduates in Uganda, 2017-2022

Project IT Graduates in Uganda (2017 - 2022 ('000))



Source: Government of Uganda, National Census Statistics & Botho Analytics

Taking a conservative approach and using an assumption of the ratio of Uganda's to Kenya's total student enrolment in HEIs of 0.47:1, we estimate that, realistically, there were about 2,400 students that graduated with computing qualifications in 2017. Applying the 2012-2016 higher education enrolment CAGR of 6.42%, this number is projected to reach 3,222 students in 2022.

Similar to Kenya, we estimate that the number of IT professionals in employment currently outstrips supply of IT professionals from HEIs, and will continue to do so during the forecast period in Uganda.

Moreover, the quality of supply fails to meet the standards demanded by the market. This was confirmed by most of the employers that were interviewed.

3.2.8 Summary of Jobs Board Data

3.2.8.1 Jobs Board Analysis

Based on analysis of 141 jobs in Kampala across 7 job boards (Angel.co, BrighterMonday, Fuzu, Glassdoor, greatugandajobs.com, jobs-uganda.com and recruit.net) over a 6-month time frame, the following are identified trends:

- 48% of all IT-related postings are for IT administration roles in networking, hardware and software maintenance.
- There is solid demand for data-related roles. 21% of all IT-related postings in Kampala are for data and business intelligence related roles including data managers, data officers, data administrators, and data analysts.
- 13% of all IT-related postings in Kampala are for developers. There is demand for junior developers with 2-5 years of experience.
- 48% of all IT-related postings are looking for mid-level applicants with 2-5 years of experience. 28% of jobs are looking for senior-level applicants with only 1% of jobs hiring at entry-level. 23% of jobs have not specified their experience requirements.
- The NGO sector is in most need for IT-related skills, accounting for 22% of all IT-related jobs posted. IT admin roles are in highest demand followed by data and business intelligence-related roles.
- The banking, finance and insurance industry is second in demand for IT-related skills at 13%, with the government third. IT admin roles are in highest demand across the two sectors.



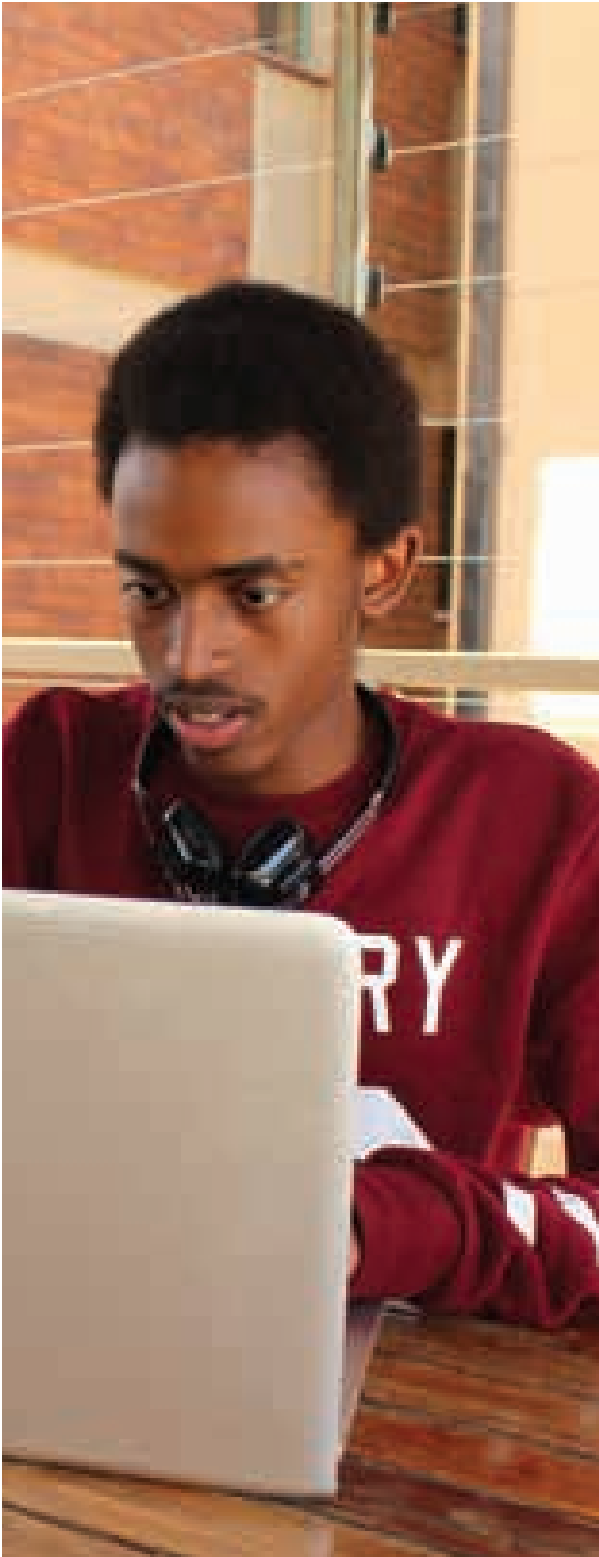
4. RECOMMENDATIONS AND CONCLUSION

Undoubtedly, digital jobs have the potential to create significant employment opportunities in both Kenya and Uganda. In order to keep pace with the exigencies of the 4IR, there needs to be a paradigm shift in terms of training and skills development, bearing in mind that both countries may not respond to global trends in the same way or at the same time. Currently, the skills gap is significant, with the major contributing factor being deficiencies in the current formal education system, where most – but not all – universities are unable to stay ahead of evolving IT skills demand.

Among other things, both universities and specialist IT training institutes should pay attention to not only emerging technologies and trends, but also the specific skills they require. One example of this in the course of our research was the tendency to dismiss C language, while highlighting IoT, though the two are inter-dependent. Introducing extensive practical application of theoretical concepts into curricula was also highlighted by employees as particularly important, especially in Kampala.

Educational providers should also consider marrying technical and soft skills more closely. Employers highlighted repeatedly how the deficiency in soft skills limited their ability to provide effective service to clients. On the employee side, 22% of survey respondents indicated that soft skills were critical for them to achieve their 5-year career plans, second only to emerging technologies. For IT professionals to take on more strategic, leadership and industry-shaping roles, the combination of soft skills and technical competency will be essential.





One of the key insights from our findings is the need to differentiate existing demand between larger firms/corporations and SMEs/start-ups. These two categories of employers often have diverging needs and demands. This, in turn, has implications for the kinds of courses that institutions offer.

Sensitization of businesses on advanced IT is necessary, whether peer-to-peer or through greater communication between the private sector and training institutions. In turn, this will help guide appropriate curricula. Many employers still do not fully understand what IT is and the role it could potentially play in their businesses and hence such sensitization could significantly improve their understanding.

The Government of Uganda might look to the Government of Kenya's more progressive policies on the ICT sector, in particular Kenya's ICT National Masterplan. Uganda's ICT plans are restricted to basic and medium IT skills, while taxation of WhatsApp and mobile money transfers restricts growth in the tech sector at large.

Finally, it is important for all stakeholders concerned to bear in mind that job pathways today take many shapes and forms – beyond traditional employment – and this is likely to further evolve in coming years. Given opportunities in freelancing, entrepreneurship, and remote work, employers need to be cognizant of how best to source and deploy IT talent, while training institutions need to consider how to best equip new cohorts for more fluid job conditions.



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APPENDICES

List of Select Stakeholder Interviews

Nairobi			
SN	Name	Role	Organization
01	Dr. Bright G. Mawudor, PhD	Head of Cyber Security (MEA)	Internet Solutions Kenya
02	Laurie Ann Fuller	Executive Business Coach	Stanford Graduate School of Business (SEED)
03	Shreyas Patel	Managing Director	Cyber Trace Ltd, IOT Solutions Provider
04	Roina Ochieng	Talent Lead	Africa's Talking
05	Wiza Jalakasi	International Expansion Lead	Africa's Talking
06	Dr. Bitange Ndemo	Associate Professor of Entrepreneurship	University of Nairobi
07	Kunle Awosika	Director, Small, Medium and Corporates (SMC), Emerging Markets (Africa & Pakistan)	Microsoft
08	Tania Ngima	CEO, Director and Board Member	Demo Ventures financial Services (Kenya and SA)
09	Seth Trudeau	Head of Product	ALX
10	Nelson Mattos	Independent Consultant (current) VP for Europe and Emerging Markets (former)	Google (former)
11	Jessica Collaco	Chief Revenue Officer	Brave Ventures Labs
12	Dr. Kagonya Awori	Lead - Human Experience and Design (HxD)	Safaricom Alpha
13	Josiah Mugambi	Co-Founder	Alba.one
14	Paul Kevin Abwonji	Application Developer	Freelance
15	Stephen Ebichondo	Corporate Account Manager	Henson Group Inc
16	Patrick Mwangi	Technical Project Manager	Housing Finance Company Limited
17	Lucas Macharia	IT Professional	
18	James Muhia	Senior Manager, Human Capital	Deloitte
19	Anthony Wagacha	Director	Centre for Digital Transformation Strathmore University
20	Mark de Blois	CEO/Founder	Upande Limited

Kampala

SN	Name	Role	Organization
01	Amy Robinson	Senior Software Product Manager	Fenix International
02	Henry Owora	Operations Manager	Cyber School Technology Solutions
03	Joe Assimwe	Hardware and Software Technician	Cyber School Technology Solutions
04	Lorna Aime	Tech Community Advocate	
05	Ray Besiga	CEO and Co-Founder	Sparkplug
06	Richard Zulu	Lead	Outbox (U) Ltd
07	Timothy Musoke	Head of Technology	Laboremus Uganda Ltd.
08	Roger Bentley	CIO	Umeme Ltd
09	Jo Kirungi	Management Consultant	
10	CK Japheth	CEO and Founder	The Innovation Village
11	Cynthia Olga Kiconco	Lead, R&D and Projects	The Innovation Village
12	Tusubira Francis	Software Engineer	AI and Data Science Lab, Makerere University
13	Dr. Evelyn Kigozi Kahiigi	Department Head	Department of IT, Makerere University
14	Engineer Bainomugisha	Associate Professor and Chair	Department of Computer Science, Makerere University
15	Kaivan K. Sattar	CEO	Asaak Financial Services

Mombasa

SN	Name	Role	Organization
01	Aly Uweso	Executive Director	M-power CBO (SwahiliBox Labs)

Kisumu

SN	Name	Role	Organization
01	James Odede	Founder	LakeHub Kisumu
02	Philip Odino	Co-Founder and Managing Partner	Winam Capital Kisumu

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