cenfri

Skills for a digital economy with a focus on Ghana, Kenya and Senegal

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mastercard foundation

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Glossary

Consumer skills	Skills required to be an effective consumer, social peer and citizen in the digital economy
Dedicated skills providers	Training providers focusing mainly on digital skills outside the formal education system
Developer skills	The digital skills required to produce value by creating and modifying digital technologies
Digital	Information or data conveyed in electronic format
Digital economy	A broad range of economic activities that use digitised information and knowledge as key factors of production
Digital goods /services	Goods and services that are intangible and can be traded digitally, including text, images, sound and so on
Digital jobs	Jobs that directly produce digital goods and that cannot be done in the absence of digital technologies
Digital skills	Capabilities and knowledge required to engage with digital technologies for social, political and economic purposes
Digital technology	Device or system that is used to process electronically stored information
European Computer Driving Licence (ECDL)	Computer literacy certification programme provided by ECDL Foundation
E- leadership skills	The ability to lead structural change in a digital economy to facilitate the creation of value
Formal education	Education provided through the conventional schooling system (primary, secondary, tertiary and TVET)
Foundational skills	Core skills that young people need to be able to accumulate technical skills for accessing job opportunities in the digital economy
Gig economy	An economic system where individuals access economic opportunities digitally from remote locations and thereby earn a living without any long-term relationship with an employer
International Computer Driving Licence (ICDL)	Computer literacy certification programme provided by ECDL Foundation in non-European countries
Industrial goods/ services	Goods and services that are tangible and require physical interaction to trade
Multi-sided digital platforms	Virtual marketplaces that connect providers of goods and services with consumers
Productive skills	Skills required to produce value by applying digital technologies
Self-learning	Self-directed learning using online content, courses or apps, including videos and games, and learning via family and friends who can coach or demonstrate how to do something
Skills for a digital economy	Capabilities and knowledge required to engage with digital technologies for social, political and economic purposes
Tech savvy	Proficiency in using digital devices

List of abbreviations

4IR	Fourth Industrial Revolution
AI	Artificial intelligence
DESI	Digital Economy and Society Index
DLP	Digital Literacy Programme
DSF One	Digital Skills Framework One
ECDL	European Computer Driving Licence
Ed-Tech	Education Technology
ENO	open digital space
EU	European Union
GCCN	Government Common Core Network
GDP	Gross Domestic Product
GIFEC	Ghana Investment Fund for Electronic Communications
GNI	Gross National Income
ICDL	International Computer Driving Licence
ICT	Information and Communications Technology
ICT4AD	ICT for Accelerated Development
ILO	International Labour Organisation
IMF	International Monetary Fund
INPG	National Institute for Petrol and Gas
IoT	Internet of Things
ITU	International Telecommunication Union
KITE	Kerala Infrastructure and Technology for Education
MNO	mobile network operator
MOOC	massive open online course
NEET	not in education, employment or training
NFOBI	Kenya National Fibre Optic Backbone Initiative
OECD	Organisation for Economic Co-operation and Development
OPM	Oxford Policy Management
P2P	Peer to peer
PSE	Emerging Senegal Plan
SMEs	Small and medium enterprises
SSA	Sub-Saharan Africa
STEM	Science, Technology, Engineering and Mathematics
TVET	Technical, Vocational and Education Training
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USSD	unstructured supplementary service data
UVS	Virtual University of Senegal

Executive summary

Digital technologies are reshaping economic opportunities in Africa and the rest of the world. The spread of mobile phones has boosted access to digital financial services and the spread of information. Increasing smartphone penetration has created new income opportunities. Through digital platforms, social media and other apps, young Africans can not only connect but they can also sell goods and services or find employment opportunities. Digitisation is evident in both the formal and informal sectors. Many African governments are making serious efforts to digitise government services and introduce some level of digital skills into the public education system.

Understanding the dynamics of these changes is fundamental to assess the requisite skills for accessing economic opportunities and identifying which opportunities will likely exist in future. Digital transformation impacts not only workers but also individual businesses, industries and national economic prospects. But what types of opportunity will exist in Africa? Where should the Mastercard Foundation focus as it evolves its strategy to develop skills for young Africans with the aim to generate employment and income in a digital economy?

Digital skills framework

The skills for a digital economy framework developed by Cenfri as part of this project provides a strong basis for locating digital skills by focusing on the outcome or application of skills rather than their content. The framework has four categories of skills for a digital economy, with skills being defined as acquired capabilities that are productive in nature, expandable and socially determined. This framework is fully elaborated in Section 3.

Operating as a citizen, friend, entrepreneur or employee in Africa and anywhere else in the world will require consumer skills as a baseline. Most of these skills are self-taught or acquired through social engagement or product induction, and are not the focus of this report.

Digital skills framework
Consumer skills are the skills needed to function socially, economically and politically in a digital society.
Productive skills are the skills needed to apply existing digital technologies for productive purposes.
Developer skills are the skills needed to develop, customise or modify digital technologies and digital infrastructure.
E-leadership skills are the skills needed to conceive and execute business models to deliver public or private goods utilising digital technologies.

Future economic opportunities

A high-level consideration of the future of work in Africa reveals the following short-term and more distant implications for digital skill priorities.

In the short term and beyond, it is clear that **productive digital skills have become a necessity to access job and income opportunities in both the formal and informal sectors**. Whether the individual operates in the formal or informal sector, the business efficiencies of going digital are simply compelling. The difference between productive digital skills required in the formal and informal sectors, to the extent that it will exist in the future, relate to the device through which the business function is executed. The current trend is to use smartphone apps for business purposes more extensively in the informal sector than in the formal sector.

In terms of net employment gains, the largest gain will be in new **digitally enabled business models.** The ability to communicate, transact and pay over digital platforms is introducing scale businesses in Africa that did not previously exist. The same applies to e-government models, which are essentially new public sector business models. If current examples are considered, the estimated three million additional jobs by 2025 is not unrealistic. Most of these jobs (drivers, e-commerce agents, etc.) will require basic productive digital skills, although a small portion will be for developer skills to engineer and maintain the platforms.

The international gig economy is not seen as a major opportunity for African youth. The production of digital goods is likely to be concentrated in economies with higher levels of developer skills and more competitive labour markets than those currently prevailing in Africa. Some countries, like Kenya, are able to exploit niche markets such as translation and language services. However, the African opportunity lies more in local gig economies that capitalise on familiarity with local culture and practices to deliver, for example, digital marketing products.

A low-wage export-orientated development strategy is not available to African countries as they strive for middle income status. Robotics and its attendant change of the competitive advantage of nations have put paid to that. To achieve middle income status, African countries will have little choice but to follow the dictates of endogenous growth theory, which stresses the critical role of *innovation and human capital*. This is the longer-term play for African economies and will require e-leadership and increasing levels of developer skills. The emerging sectors that should be focused on are services, the broader consumption-driven economy and digital agriculture. Two of our diagnostic countries – Kenya and Ghana – are bucking the trend with increasing contributions by the agricultural sector to their GDP, both as a result of focused interventions predominantly riding on digital rails. Africa's comparative advantage in agriculture, as well as the continental population explosion up to 2100, suggests that Africa should cultivate centres of excellence in digital agricultural technologies.

Summary of key findings

i. **The informal sector,** where 80%+ of African youth earn their income, is a social media economy. To function on the social media platforms and use digital payments require basic consumer digital skills. These are mostly self-taught or acquired from product induction.
ii. **The mobile phone is the digital device of choice or necessity** for business purposes in the informal sector.
iii. **Digitally enabled platform business models** that deliver industrial goods and services create new income opportunities that require consumer skills and some productive digital skills.
iv. **Most formal sector jobs** and more informal sector jobs require growing levels of productive digital skills.
v. **Workers in the gig economy,** where digital goods and services are produced and traded, require more advanced productive skills, but the income opportunities in sub-Saharan Africa (SSA) are limited.

vi. **The small but growing ICT and tech sector** requires advanced digital developer skills that are not currently produced by either public or private education in our target countries. There is a strategic gap in developer skills, which limits the ability of target countries to reach middle income status.

vii. **Public and private leaders and innovators** are required to navigate and shape systems and business models able to thrive in the digital economy. E-leadership skills have become essential for their success.

Learning approaches

What are the best approaches for learning digital skills? The following approaches emerge from current experience as having the best potential for creating a tipping point for the employability of youth in Africa.

Digital skills, including coding, at primary school. Introducing practical digital skills, including coding, at primary level has the greatest potential for long-term, country-wide impact. We believe this is a stretch goal or moon-shot that will change the game more than any other intervention. It can achieve scale, with equity, for early learning of consumer, productive and even developer skills. It will reach almost all students, regardless of gender, ethnicity and socio-economic background. It provides an opportunity for *all* students to gain confidence in using technology and to experiment with creating content and build navigation skills. Given the scale, the cost per child would be lower, thus also making this option cost-effective.

Productive skills as standard for secondary schools. Given that a greater number of secondary schools already have access to electricity and some hardware and internet connectivity, secondary education interventions can leverage existing infrastructure to improve teaching digital skills. Technology should be applied to non-ICT lessons to build a strong base for productive skills. Given the low number of students selecting Computer Science, this approach would reach the greatest number of students in secondary schools. Industry talks and opportunities for exposure tours or competitions for the best Computer Science students could encourage further enrolment in the subject. However, expanding from Computer Science into broader ICT, including multimedia, would reach a greater number of students. Secondary schools provide the opportunity for scale, but at a lower rate than primary schools.

Digital by default in tertiary education. Although the number of young people enrolling at university each year is low, tertiary education has seen huge growth over the last decade and this growth is likely to continue. A requirement that all students use computers for assignments and presentations (either personal or shared facilities) would drive self-learning and a purposing of digital technology across all subjects. Introducing students to internet research, online collaboration tools and platforms for sharing and uploading work, as well as exposure to digital data analysis, would contribute to building not only productive skills but also early e-leadership skills. Where there are fewer institutions in a country, interventions can be tailored to suit needs and be more cost-effective. All lecturers and faculty staff should be required to pass the International Computer Driving Licence (ICDL) or similar to raise the basic standard and facilitate the digitisation of tertiary learning. Students could opt to do the same, as certification would boost employment potential.

Replicate and scale the best digital academies and universities. High-quality university courses in Computer Science and dedicated coding academies are the best for teaching developer skills. Blended learning approaches that combine classroom time with online learning build theory and practical skills, while providing access to guidance and support. Several gender-based courses have emerged, which seek to close the gender gap and boost young women's confidence and competencies in digital skills. Merit-based scholarships or subsidised places can increase equitable access, although these would require external funding to be viable. By scaling the best teaching and building strong industry links for employment, the appropriate level of scale for higher-end developer skills can be achieved, especially in tertiary institutions. Those that include additional training in business, entrepreneurial mindset and design thinking can further strengthen employability for their alumni.

Open digital spaces. Given the high number of youth not in education, employment or training, community learning centres or open digital spaces (to borrow from the Senegalese concept) can extend the reach of digital skills with equity. Leveraging existing infrastructure where possible, redesigned to be attractive and welcoming places for all young people, such spaces allow young people access to the internet and technology, and take advantage of self-learning (via massive open online courses or MOOCs) or are taught opportunities on site. Open digital spaces, when combined with trained staff or digital brokers, have the

potential to address the gaps in digital skills in a meaningful way. The focus here is on building consumer and productive skills to enhance opportunities in the informal market.

Industry-linked e-leadership training opportunities. E-leadership skills are best taught through industry-linked training and exposure tours to digital centres of excellence or leading digital businesses. Access to existing e-leaders through networking events or mentoring can strengthen young rising stars (from public or private sector, or in tertiary education) to become e-leaders. Ideally, this should be combined with self-learning opportunities for significant skills to emerge, including classroom-based learning focused on real-world solutions, at high-quality tertiary institutions or innovation hubs, and digital economy focused MOOCs. This will provide the practice-theory-exposure combination needed for e-leaders to emerge. This can be achieved through programmes that promote emerging talent, such as the top 30 e-leaders under 30, for dedicated acceleration programmes linked to industry and cutting-edge approaches. Exposure tours of one to three months in a country with a well-established digital economy would expose young leaders to high-quality systems and business processes, which may be unavailable in their home countries.

Leverage online certification for all public sector workers. The rise of e-government services is impacting the demand for productive digital skills across the public sector. This includes staff in education and health sectors, building and transport licensing, and legal and trade sectors. Given the number of people employed by governments in Africa, raising the standard of digital skills with public sector workers will achieve huge scale and enable e-government systems to function, with positive knock-on effects for all citizens, including young people. Existing standards such as the ICDL can be leveraged. As staff move from public to private sector, certification must be transferable.

Self-learning through use of digital products. Given that consumer skills can mostly be self-learned, the utilisation of digital platforms or products are also an ideal mode to learn-by-doing, including e-government services. Building on consumer skills, the use of digital platforms and apps by merchants to boost business opportunities can also build productive skills by default.

Summary of key findings

i. **Teaching coding at primary schools.** More countries teach coding at primary school, which provides equitable access and increases the pool of students that will pursue digital skills later in school and tertiary education.
ii. **Missed opportunity to teach digital skills in secondary schools.** Digital skills is more than computer science, but is often reduced to this, and an insufficient number of students choose it as an elective since it is not compulsory.
iii. **Digital by default in tertiary education.** The institutions that require students to submit work digitally produce graduates with stronger productive digital skills.
iv. **Certification in ICDL or similar.** Quality standards can be raised by introducing certification in computer-based digital skills. This has been widely used in Europe to increase productive skills of school graduates and public sector staff.
v. **Learning apps for all subjects.** Successful apps such as Khan Academy provide access to high-quality content for all ages and subjects. Some African Ed-Tech apps are now available but have not achieved scale. However, these apps position themselves as providing solutions for Africa in the form of context-appropriate content in local languages, low-data usage or offline content.
vi. **Foundational skills can be strengthened through tech-assisted learning.** Programmes that learn a student's level of knowledge and set progressively harder challenges have proved effective at boosting foundational skills, especially in Mathematics. This can overcome the challenge of large class sizes and varying learning abilities.

Country diagnostics

The country diagnostics in Ghana, Kenya and Senegal reveal both common and distinctive opportunities for increasing digital skills. Common opportunities include significantly increasing the teaching of productive skills at secondary schools. Common obstacles to achieving this are the absence of an appropriate curriculum, including smartphone-enabled teaching of productive skills, and that it is not compulsory to learn digital skills.

The labour market reality across all three countries is that the bulk of the youth beyond school age did not receive adequate training in productive skills. For the more enterprising among them, the best option is to create open digital spaces, staffed by trained digital brokers who are able

to train and intermediate between attendees and the digital world. The function and importance of the digital broker is expanding across Africa and requires more attention and focus.

The opportunity to teach productive skills to public servants is also a common relatively low-cost opportunity at scale for all three countries.

Summary of recommendations

i. **Digital as baseline skills for earning.** Digital skills are critical to earn income in the future economy, be it the formal or informal sectors.
ii. **Do not focus on consumer skills.** Consumer skills are mostly self-taught on mobile devices. This will continue as the prevalence of smartphones grows and the cost of data reduces.
iii. **Two-pronged approach** is necessary – a short-term strategy should focus on the optimal acquisition of productive skills for youth in school and who have already left school. A long-term strategy should aim to build top class developer skills and e-leadership skills to drive the digital economy in African countries at every level.
iv. **Youth in school.** The most cost-effective strategy to achieve in both the short and longer terms is to improve the teaching and practice of digital skills in the public-school system.
v. **Youth out of school.** For youth who have already left school without adequate digital skills training, as well as those who will leave school in the short term while the system is still being upgraded, create digital open spaces that provide training, as well as online access for entertainment and working.
vi. **Youth in employment.** The best opportunity to upscale the digital skills of youth in employment at scale (recognising that private firms will do their own on-the-job training) is to focus on government so that they require all employees below a certain age to take the ICDL and achieve certification. Such a certificate will make them attractive to public and private employers alike.
vii. **Youth in tertiary education.** A sea change is needed in the incentives for students to take STEM courses as well as the content and orientation of courses. The link between training entities and industry must be dramatically increased and entities that do this well – of which there are a few examples – must be celebrated and encouraged.

viii. **Developer skills.** This is where a long-term strategy is required. We believe the single biggest change will be to launch a programme that introduces teaching of coding in primary schools. This will start to change the mindset of youth and also create a large enough pool of potential coders to build the digital future. Such a programme should start with pilot schools and gradually extend to all primary and then secondary schools.

ix. **Optimising digital training capacity.** The lack of sufficiently trained digital teachers is a global problem, not just an African one. The answer lies in changing the notion of a teacher – to incorporate persons who already work and want to expand their income. There is no reason why the facilitators at open digital spaces cannot also teach digital skills in schools. A comprehensive and pragmatic approach is now required.

1. Introduction

This is the final report for the *Landscaping Study on Youth Skills in a Digital World*. It forms part of the Mastercard Foundation's larger enquiry into strategies to enhance the skills of African youth for improved employment opportunities and income generation.

Objective. The Foundation wishes to develop an integrated, flexible framework and approach to enable African countries to advance youth skills for work in a digital world. As such, it seeks to understand (1) the landscape of definitions, frameworks, methodologies and approaches to fostering youth skills for a digital world; (2) the landscape of global and regional actors and their approaches to fostering youth skills in a digital world in Africa; and (3) the needs and priorities of employers and others with a strong interest in the types and quality of digital skills emerging in Africa. Lessons and opportunities should then be distilled for the Foundation's strategy to enable work for youth in Africa. The intent is to inform the country teams as they identify opportunities and devise strategies for national engagement to enable youth skills.

Approach to identifying recommendations to support digital skills development in Africa

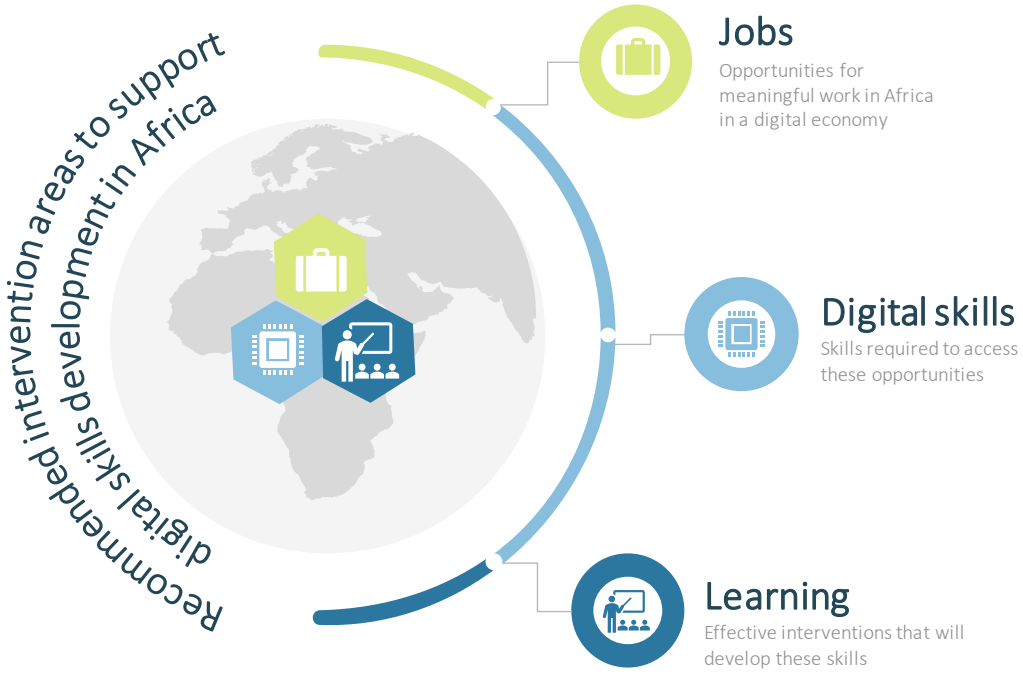

Figure 1: Our approach

Approach. The research team used a multi-pronged approach to generate evidence and insights for this landscaping study:

- ***Literature review.*** A review was done of existing approaches to define digital skills and how these skills are learned. This included interviews with several individuals and institutions active in this field. The team benefited greatly from the skills framework developed by Oxford Policy Management (OPM) for the Foundation, which locates digital skills within a larger skills development framework.
- A parallel literature review was undertaken on the *future of work* in the digital economy, especially how this applies to emerging markets and the African continent. The purpose of the review was to identify the most likely income-earning opportunities for young people in the digital economy and the skills they will require to capitalise on those opportunities. The intention is to ground the discussion on skills for a digital economy within the competitive economic realities of an African country in a global world.
- ***Primary research.*** The team undertook primary research in Kibera, the largest informal settlement in Nairobi, Kenya. Data on the presence of digital skills in Africa is limited. Moreover, in Kenya and other SSA countries, the informal sector plays a key role in the labour force. This makes it challenging to accurately index important skills by analysing official labour statistics. Furthermore, the wide variety of ways to learn digital skills, combined with the variable quality of instruction and resources present in these learning environments, means that measuring digital skills by assessing credentials is cumbersome and potentially futile. By testing the digital skills of young people and combining these results with in-depth interviews, it was possible to get context-driven and detailed data on what skills young people actually have, the way that they attained these skills, and how they apply their skills to create value in an increasingly digital economy. Furthermore, interviewing business owners and Human Resource managers provided invaluable context from the demand side of the labour market to understand what skills are needed and where gaps reside.
  A separate report on the qualitative research is available.
- ***Stakeholder interviews.*** The team interviewed experts in education, digital technology and youth skills development to gain broad insights and test hypotheses.

- ***Country diagnostics***. The team undertook diagnostic exercises in Ghana, Kenya and Senegal to understand the demand and supply of digital skills in each country, the demographic and market dynamics driving these, and the regulatory and policy approaches in place. The Kenya and Ghana diagnostics included in-country visits, while the Senegal diagnostic was via voice calls and secondary research only.
- ***Expert roundtable***. An expert roundtable meeting was convened in Nairobi during the Kenya diagnostic to test the operative frameworks and approaches that shape the findings in this report.

Report structure. The report is divided into five sections. **Section 2** examines the reshaping of work in the digital economy. It explores how the different dynamics in which digital technology, the technologies that ride on digital rails and resultant new business models reshape work, and also outlines income opportunities in African countries. **Section 3** presents a framework for digital skills. It describes the current thinking on the nature of digital skills and suggests a typology based on the purpose for applying the skills rather than on their technical nature. **Section 4** examines existing approaches to learning digital skills and suggests a typology based on the nature of the institution transmitting the learning. **Section 5** captures insights from the three country diagnostics, lifting out current realities around the state of digital skills and opportunities for advancing these. **Section 6** concludes and makes recommendations for potential engagements in the three diagnostic countries. **Section 7** includes the appendices: a list of stakeholders interviewed, tables visualising the assessment of different learning approaches, and the references used in this report. A separate **Appendices** documents the full scan of digital skills providers assessed.

2. Digital reshaping work

As digital technology and other technologies that ride on digital rails continue to change the way in which people access economic opportunities, understanding the dynamics of these changes becomes fundamental for assessing the requisite skills for accessing economic opportunities. These changes impact not only workers, but individual businesses, industries and national economic prospects. Before answering the question about how to inculcate digital skills, the prior question must be answered: What are the likely economic opportunities that will exist in a given country as the digital revolution spreads across all economic sectors and all levels of society? This section elaborates on six key trends through which the digital sector is reshaping economic prospects.

2.1. Existing jobs becoming increasingly digitised

Digital technology enables the private and public sectors to conduct business more efficiently and thereby be more competitive. As a result, existing jobs are becoming increasingly digitised to enhance the efficiency at which employees work.

Digital is becoming a bigger part of all jobs. This dynamic has been pervasive in the past few decades and will more than likely continue at an accelerated pace. For example, professions that traditionally had elementary skill requirements, such as receptionists and couriers, have adopted a range of new digital skill requirements. Basic word processing skills for receptionists have evolved into required proficiency in a broad range of Microsoft Office suites, cloud computing software to share files, and other office management-related software packages. Couriers must now be able to use mobile applications, such as Google Maps and Uber Eats, to engage with clients and for navigation. Marketers are required to utilise and analyse social media platforms to effectively reach their target markets.

Informal sector is gaining digital content. In Africa, most workers are active in the informal sector. The International Labour Organisation (2018) estimates that this represents 86% of workers. The digitisation of work also impacts the

informal sector. Our qualitative research[1] shows how backyard auto-mechanics use diagnostic software to obtain a competitive edge over other providers of similar services. Informal entrepreneurs, such as hairdressers, tailors and artists, are using social media platforms such as WhatsApp, Instagram and Facebook to market their services. The greater reach increases income and the entrepreneurs' ability to employ workers. Digital financial services, accessed primarily through mobile phones, enable millions of informal workers to be paid cost-effectively (Hruby, A, 2019).

In an unrelated project, Cenfri interviewed 25 main income earners (equal numbers of men and women) in Kenya of whom 60% worked in the informal sector and 60% were aged 20–34 years old. Twenty of the respondents had between 10 and 40 apps on their phones and permitted the researchers to look at their phones to verify the presence of the apps. Apps used most frequently were for business purposes, whether the respondents were full-time employees or had their own businesses. Apps were used for making and receiving payments, sending files or PDFs, finding locations and learning how to do things on YouTube. Examples used by respondents include Xender (to share files), WSP (to write and view documents, Adobe (pdf), Antivirus, CamScanner, Air BnB (to find affordable accommodation when travelling for business), Kopo-Kopo (to prepare business ledgers), and I-Track (to track vehicles)[2].

The development of e-government in Africa, a major use case for digital skills. The United Nations has identified e-government as a mechanism through which to build sustainable and resilient societies. Governments across Africa – most notably Ghana, Seychelles, South Africa and Tunisia – have successfully implemented e-government initiatives (UN, 2018). As ICT infrastructure improves across the continent and the resultant cost-benefit of delivering public services digitally, the number of e-government services will increase. Even though Africa still lags behind the rest of the world[3], the digital skills required to engage in

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1 See our Tech savvy report: https://cenfri.org/wp-content/uploads/2020.05_Techsavvy-report-on-experimental-qualitative-research.pdf

2 The same project also interviewed 25 respondents with the same profile in Nigeria. Nigerian respondents had relatively few apps on their phones and did not use a range of apps for business purposes. Only two respondents had more than 10 apps on their phones. Unlike the position in Kenya, respondents would not allow interviewers to look at the apps on their phones. They valued the convenience of digitisation but were generally quite sceptical about apps that involved their bank accounts. In most cases they would only use an app if it was recommended by a trusted family member or friend.

3 In the 2018 edition of the UN's e-government survey report, Africa scored the lowest in the e-government development index with an average of 0.34 compared to the world average of 0.55. For more information see:

online citizenship are becoming increasingly important. Young people entering public employment will increasingly need digital skills to do their work.

An increase in digital content necessitates the acquisition of digital skills for the entire population. As virtually all traditional job types gain digital content, individuals without digital skills risk marginalisation in the formal and informal sectors. Therefore, digital skills are not only a requirement to access jobs in the technology sector, but also to compete for positions in other traditional sectors.

2.2. Digital technologies leading a new wave of creative destruction

Digital technologies are not only reshaping the content of existing jobs, they also create new types of jobs. Digital innovation creates new economic opportunities through the development of tech-enabled products and services. The result is new types of industries and business models that present fresh opportunities. However, this process of creative destruction[4] is also making certain existing jobs obsolete.

New business models are creating new jobs of an old nature. Digital technologies enable new business models. This can create work opportunities, but not necessarily of a completely different nature. For instance, mobile payment services on the continent are facilitated by a multitude of cash-in and cash-out agents. These services are not dissimilar to those rendered by bank tellers since the advent of networked banking. However, the existence of digital communications has enabled these 'tellers' to be located far from bank branches and within pre-existing small local businesses. In the process, hundreds of thousands of new income-earning opportunities were created. Jumia, the e-commerce platform, employs only 3,000 people across Africa. However, it also rewards approximately 100,000 commission-based affiliates to help customers make orders through the online platform (Ng'weno and Porteous, 2018). Again, the business model is new, but the jobs look distinctly familiar and even ancient in content.

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https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2018

4 Creative Destruction is a term coined by economist Joseph Schumpeter in Capitalism, Socialism and Democracy (1942). It refers to the process through which innovation results in the demise of whatever existed before it. It describes how "the process of industrial mutation incessantly revolutionizes the economic structure from within, incessantly destroying the old one, but incessantly creating a new one."

New digital technologies create entirely new work opportunities. The acceleration in digital innovation in the 21st century has been unprecedented. Technologies such as cloud computing, big-data analytics, robotics and artificial intelligence (AI) are replacing outdated technology, which have employment implications across the entire economy, from mining and healthcare to the information and communication sector. Figure 2: indicates the global shift in job types as anticipated by employers in the WEF Future of Jobs Survey 2018. Employers expect 27% of all job types to be completely new. For example, PWC (2019) estimates that the economic opportunity presented by AI technology could boost global GDP by up to 14% in 2030, which is an additional USD15.7 trillion. As AI becomes more pervasive, jobs relating to the creation, utilisation and optimisation of AI for business processes will increase. A further testament to the importance and transformative power of digital innovation has been the elevation of IT Officers to executive Chief Technology Officers in companies.

Existing jobs are disappearing. Disruptive technologies not only create new jobs, but also destroy existing jobs. For instance, the advent of AI poses a real risk for many jobs that involve repetitive, non-creative processes. However, countries can avoid significant structural unemployment with comprehensive digital skills training. Without adequate skills and the opportunity to upskill, short-term unemployment caused by industry changes can become long term. While 133 million new jobs may emerge globally as a result of the fourth industrial revolution (4IE), another 75 million may disappear due to shifting global markets and the rise of automation (WEF, 2018). As indicated in Figure 2:, globally employers expect 21% of current jobs to be redundant by 2022. The IMF estimates that the percentage of jobs that will be automated in SSA could range from 40 to 60%, depending on the country (IMF, 2018).

More digital skills will be required to reap benefits from new jobs. The successful examples of how M-Pesa and Jumia used new digital technologies to create value in Africa is indicative of how digital technologies can create employment opportunities for young people in the future. However, Africans will need to grasp the opportunity to acquire complex productive and developer digital skills to create innovative solutions for local consumers to avoid becoming redundant. These will need to be combined with key soft skills, such as creativity, critical thinking and collaboration. Not only that, e-leadership skills will be vital to identify and seize economic opportunities through digital technologies.

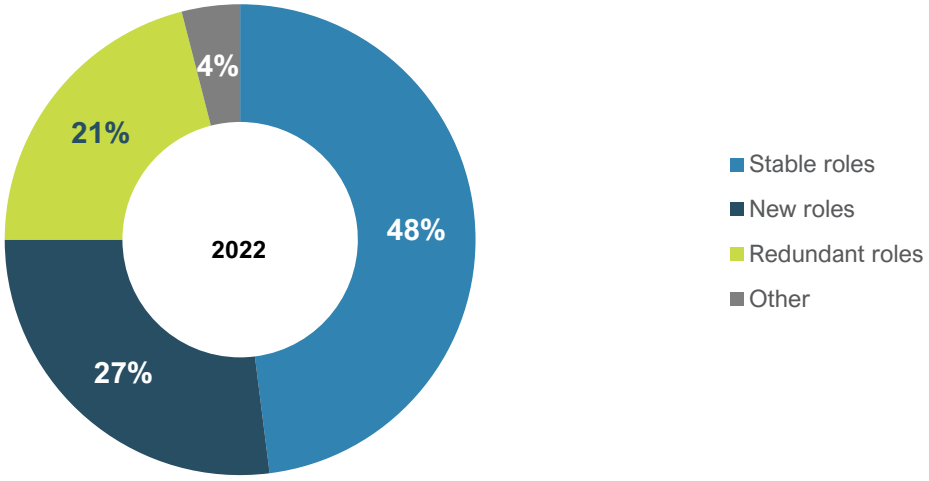

Figure 2: Projected change in job roles between 2018 and 2022

Source: WEF, 2018

2.3. Digital technologies impacting the development paths of countries

The comparative advantage of countries is likely to change as the global economy becomes more digitised. Endogenous growth theory[5] stipulates that productivity growth is directly linked to the level of innovation and human capital in a country (Romer, 1994). Countries with higher levels of innovation and human capital will create relatively more economic opportunities. In contrast, those that rely heavily on cheap labour to drive their economy may find themselves at a competitive disadvantage to countries utilising innovative technologies. What is clear is that the development path that prevailed in the 20th century, where countries moved consistently from a primary sector focus to an industry-led economy and ultimately a services-based economy (Rostow, 1959), no longer holds. The export-led success of the Asian economies in the 20th century will not be available to Africa in the 21st century, if it ever was. Manufacturing, as a share of total economic activity in Africa, stagnated at approximately 10% (Coulibaly, 2018).

5 Endogenous growth theory focuses on economic growth as an outcome of processes endogenous to an economy. Thereby, it does not assume, like the neoclassical economic growth model, that technological change is an exogenous process that drives productivity. Rather, it emphasises the contribution of human capital, innovation and knowledge to economic growth.

The preferential location for manufacturing is changing. Sophisticated digital technologies, such as robotics, 3D printing and internet-based integration systems, are shifting the preferential location for manufacturing. In a rapidly digitising economy, it is not the supply or cost of labour that will drive the manufacturing industry but technology and human capital. As the cost of technology falls in developed economies relative to the cost of labour in developing economies, reshoring will accelerate[6]. Table 1 indicates the number of companies that have reshored back to the US between 2010 and 2016.

Region	Companies reshored	Jobs lost
Asia	1,112	138,450
Western Europe	528	103,879
North America	235	35,186
Middle East	34	5,991
South America	21	3,963
Australia	20	1,398
Eastern Europe	21	1,045
Africa	7	885

Table 1: Impact of reshoring of US companies (2010–2016)

Source: Adapted from SET Digitisation and future of African manufacturing (2018)

Banga and Te Velde (2018) estimate that by 2033 the cost of labour in Kenya will be more expensive per unit of manufacturing than the cost per unit of robotics-based manufacturing.

Africa will need a different economic development path. The bulk of employment in Africa is based in the agricultural sector. The rise of digital technologies is likely to result in a new wave of automation in commercial agriculture. This will cause a decrease in labour absorption but will enhance productivity. In subsistence agriculture, technological innovation will enable information flows, which will make it more feasible for small units of production to be linked to

6 Firms such as Philips and Adidas have re-shored some of their factories to Europe, as the cost of automated manufacturing becomes cheaper than labour on a per unit basis. For information see: https://www.economist.com/business/2017/01/14/adidass-high-tech-factory-brings-production-back-to-germany

global value chains and potentially be more competitive on international markets. Furthermore, Africa has already seen a significant growth in its services sector in the past few decades. Between 1998 and 2015, services exports from Africa grew six times faster than merchandise exports. A number of countries on the continent also boast a flourishing ICT sector, in particular Kenya and South Africa, which can contribute to this growth (Brookings Institute, 2018).

Without human capital, economic development may be difficult to achieve. Local innovation and human capital formation will therefore be critical factors in Africa's economic development story of the future. Without it, Africa may be able to access some of the lower-end basic skilled jobs, but the advanced skilled jobs – which create the most value – will be elsewhere in the world. To drive local innovation and attract human capital requires e-leaders. E-leadership skills are necessary to formulate public policy, build digital skill initiatives and seize high value economic opportunities. Africa has a large, growing population and has a significant amount of fertile unused land. Therefore, these high value economic opportunities are most likely to lie in consumption, services and agricultural production.

2.4. Growth of the gig economy and online work

The rise in internet penetration and digital financial services has improved the ease with which the private sector can access and remunerate labour across the globe. Furthermore, digital technology makes it increasingly feasible to decentralise and distribute tasks. Digital platform technology facilitates the matching of employers with workers that meet their requirements. Employers conduct payments through labour platforms based on work delivered digitally. The growth of a digitally enabled labour market has given rise to the so-called *gig economy.* In the gig economy, individuals can access economic opportunities digitally from remote locations and thereby earn a living without any long-term relationship with an employer.

The gig economy is significant and growing. A recent study funded by Mastercard estimates the value of the global gig economy in 2018 at USD204 billion. Figure 3 indicates the anticipated trend. The size of gig economy transactions is expected to grow at an annualised rate of 17%, reaching a gross volume of approximately USD455 billion by 2023

(Mastercard, 2019). The Online Labour Index[7] indicates that the number of projects completed in the global gig economy is growing at a rate of 7% per annum[8], with only 2.5% of total projects originating in Africa. At a local level, industrial goods or services[9] remain a key driver for the demand of labour in the gig economy. Activities such as couriering dominate local markets, as industrial goods and services either require face-to-face interaction or are logistically costly. In the global gig economy it is different. Digital goods and services[10], such as software, graphic designs and data entries, generate the largest demand for online work at an international level. Even demand for professional services such as accounting and law are slowly becoming more prevalent in the global gig economy. Digital goods and services do not require face-to-face interaction and is logistically inexpensive, making it ideally suited to be produced at one end of the world and consumed at the other end (Kässi and Lehdonvirta, 2018).

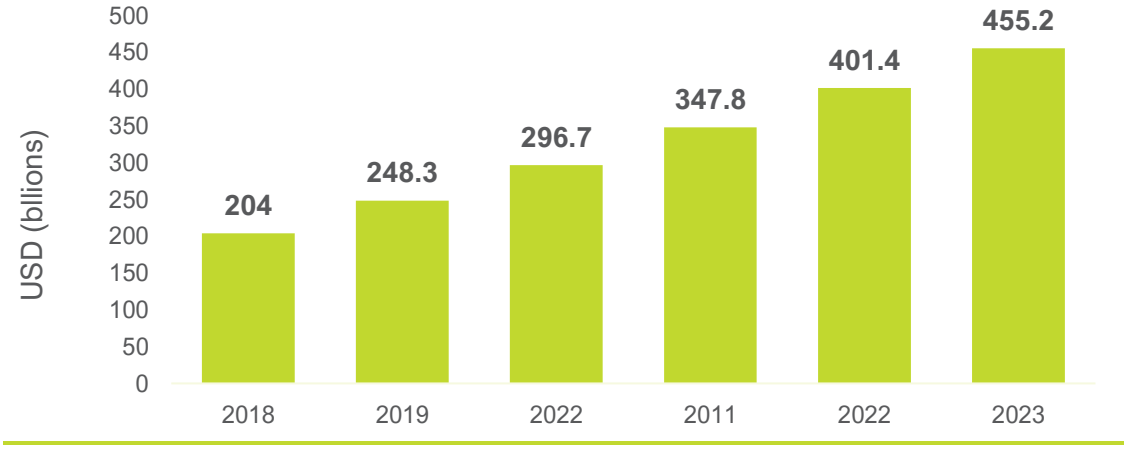

Figure 3: Estimated size of the global gig economy

Source: Mastercard, 2019

Global competition in the labour market will intensify. Accessing economic opportunities in the gig economy is open to anyone with an active internet connection and the requisite skills. The result is a much more interconnected labour market in which workers compete at a global level.

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7 The Online Labour Index is calculated by the Oxford Internet Institute. It is the first economic indicator that provides an online gig economy equivalent of conventional labour market statistics. It measures the supply and demand of online freelance labour across countries and occupations by tracking the number of projects and tasks across platforms in real time. For more information see: http://ilabour.oii.ox.ac.uk/online-labour-index/

8 This is an estimation based on the index value measured on 25 August 2016 and 25 August 2019.

9 Industrial goods and services are defined as goods and services that are tangible and require physical interaction to trade.

10 Digital goods and services are defined as goods and services that are intangible (can be fully captured digitally) and can be traded digitally.

This is particularly true in the labour market for digital goods and services. For example, in software development, the end-user of the software is not restricted to his local labour market to find a worker that can design the software but can find someone anywhere in the world. In this new paradigm of labour market competition, the importance of human capital is even greater than before. Countries in which education systems do not adequately foster the acquisition of human capital will be outcompeted in the production of digital goods. Furthermore, if the underlying structure of the economy is uncompetitive, for example a high-wage environment, that country runs the risk of seeing entire sections of its digital production being outsourced through the gig economy.

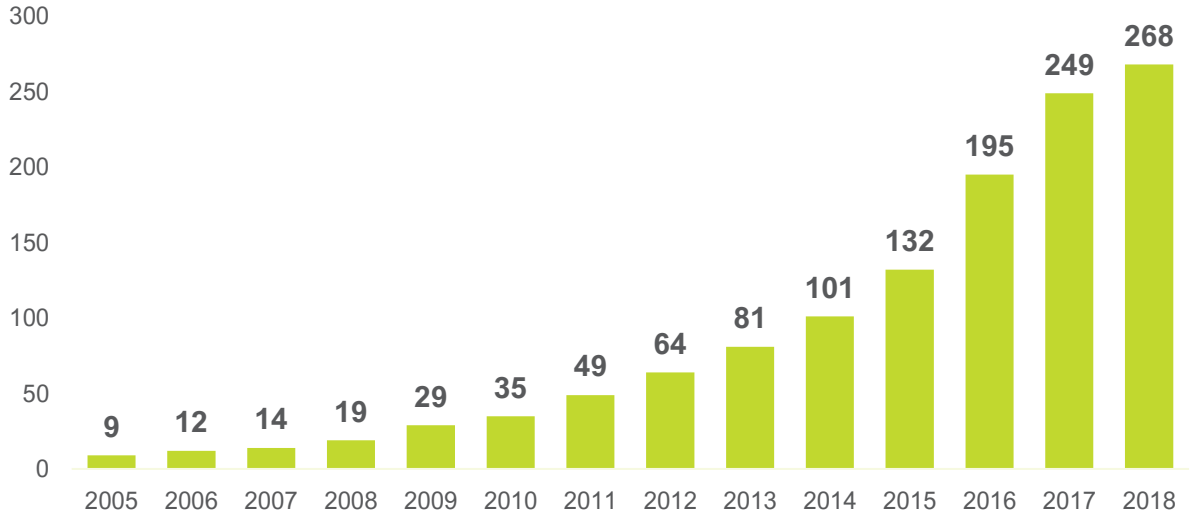
The gig economy presents large opportunities for Africa, but not without risks. The projected growth in the gig economy makes it clear that this holds significant work opportunities for young people in the future. It provides young Africans with the ability to gain experience doing jobs they may not have access to otherwise. However, the gig economy poses risks to young Africans as well. Without adequate productive and developer skills attainment, they will find themselves outcompeted at a global scale. If the quality of the digital goods and services delivered by Africans is not up to par, they will struggle to find work. Furthermore, gig economy work, by definition, does not come in the form of permanent contracts, which will make workers vulnerable to exploitation.

2.5. Boom of e-commerce through multi-sided digital platforms

Multi-sided digital platform[11] technology is enabling the creation of virtual marketplaces. Virtual marketplaces bring together merchants, customers and logistical providers in order to facilitate e-commerce. The rise of virtual marketplaces and the associated efficiency gains provide a significant employment opportunity for young people in the digital economy.

11 Multi-sided digital platforms are virtual marketplaces that connect providers of goods and services with consumers. Platforms that connect buyers and sellers, such as village market squares, are as old as human economic interactions. The digital nature of emerging platforms allows for the matching of new services (e.g. e-hailing) with fewer geographic constraints (e.g. online shopping and freelance). Advances in online payment instruments also allow for the payment of goods and services on these digital platforms. For more information see https://cenfri.org/publications/africas-digital-platforms-and-financial-services/

Multi-sided platforms enable people to access a larger market. This dynamic is playing out at a global and local level. Firstly, businesses such as Amazon and Africa Sokoni have been able to leverage digital platform technology to become digital aggregation points for e-commerce through which other retailers sell their goods to consumers. According to a 2019 insight2impact study, Africa is already home to more than 250 digital platforms with 1.3% of adults in the focus countries earning an income from these platforms, as shown in Figure 4. The Boston Consulting Group (2019) estimates that these digital platforms can create up to three million new jobs in Africa by 2025, ranging from drivers and customer service staff to software engineers.



Note: Countries included in scan: Ghana, Kenya, Nigeria, Rwanda, South Africa, Tanzania, Uganda and Zambia. Launch year unknown for nine platforms.

Figure 4 Cumulative number of digital platforms launched in Africa

Source: insight2impact, 2019

The scale and efficiency gains provided by digital platforms create opportunity. Virtual marketplaces increase the efficiency of facilitating connections between providers of goods and services and consumers. It reduces the need for physical interaction to conduct trade and therefore carries cost-saving benefits to the economy as a whole. It also allows for higher asset utilisation. For instance, Cramer and Krueger (2016) found that the occupancy rate of Uber vehicles is 30% higher than that of conventional taxis. In an African context, which is scarce in capital, utilisation rates of assets matter all the more.

Success factors for harnessing digital platform technology. There are a number of factors that will affect the economic impact of virtual marketplaces in Africa. Without ubiquitous access to internet and digital payment mechanisms, the benefits will not accrue to the majority of the population. Virtual marketplaces rely on a trust-based system that runs on ratings provided by the digital community. However, different cultural groups value the opinion of unknown individuals differently in the digital community[12]. In addition, interfacing with e-commerce platforms requires more advanced consumer skills. Job opportunities that support the e-commerce ecosystem will require productive skills to facilitate trade and transactions, and developer skills to create and maintain the technologies that enable the platforms to operate successfully.

2.6. Ecosystem effects

The evolution of ecosystems in the digital economy will play a significant role in the trajectory of economies in Africa and across the world. Growing internet penetration, an increase in digital skills, the emergence of new technology, and the establishment of innovation hubs serve as enabling conditions for an environment in which tech-savvy individuals can learn and thrive. A thriving ecosystem attracts further talent, which in turn support economic development.

The rise of tech hubs is indicative of Africa's digital ecosystem. Innovation and tech hubs are now common in Africa's major cities. According to GSMA (2019), the number of active tech hubs[13] in Africa has grown from 314 in 2016 to 618 in 2019, an increase of almost 100% in three years. Nigeria and South Africa have the most advanced digital ecosystems, with 85 and 80 active tech hubs respectively. However, other African countries are also positioning themselves as regional hubs, such as Kenya, and are attracting interest from large companies such as Microsoft. Ghana is also a favoured location; IBM, Intel, Microsoft and Google have all established operations there, seeking to capitalise on the emerging talent pool accumulating from the digital ecosystems.

12 Omydiar/insight2impact African digital platforms study (forthcoming)

13 GSMA defines a tech hub as "an organisation currently active with a physical local address, offering facilities and support for tech and digital entrepreneurs."

Productive ecosystems are built on the back of digital ecosystems. Production ecosystems are where production is clustered to create scale for large e-commerce platforms. An example of this is Taobao villages, which are areas in rural China that are significantly engaged in e-commerce. In 2013 there were 20 Taobao villages with total annual e-commerce transaction volumes of RMB10 million or more, and at least 100 active online shops. By 2018, there were 3,202 transacting at this level. Small and medium enterprises (SMEs) founded around these zones create an ecosystem that can help in achieving scale (Luo, 2018). However, this type of ecosystem has not yet emerged in Africa.

Investment in infrastructure and digital skills necessary to create digital ecosystems*.* A conducive environment for tech innovation, along with a professional base with strong e-leadership skills, can help to attract investment in the tech sector and create job opportunities. To maintain recognition as digital hubs, countries will need to expand developer digital skills talent domestically and grow their start-up ecosystems. Building a strong pool of e-leadership skills can contribute to creating more diversified economies and allows nations to develop new channels of competitive advantage to compete in the global market.

2.7. Conclusion

Productive digital skills a necessity to access job and income opportunities in the future. Within the next decade, very few jobs and income opportunities will remain in Africa's formal or informal sectors that do not require productive digital skills. The business efficiencies of going digital are simply compelling. The difference between productive digital skills required in the formal and informal sectors, to the extent that it will exist, will relate to the device through which the business function is executed. The current trend is to use smartphone apps for business purposes more extensively in the informal sector than in the formal sector.

Digitally enabled new business models create scale and opportunity. The ability to communicate, transact and pay over digital platforms is introducing scale businesses in Africa that did not exist before. Our current assessment is that on a net basis they create new jobs and income opportunities that did not exist before. If we consider current examples, the estimate of 3 million additional jobs by 2025 is not unrealistic. Most of these jobs, drivers, e-commerce agents, etc. will require basic productive digital skills, although a small portion will be for developer

skills to engineer and maintain the platforms. Some digitally enabled business models will also destroy jobs, for example in the Kenyan flower industry (see country diagnostics in Section 5). However, the net income and employment gains of introducing digital technology to African agriculture are likely to be positive due to the productivity and trade gains.

Gig economy offers fewer opportunities in Africa. The production of digital goods in the gig economy would seem to offer fewer service export opportunities for African countries than for other economies with higher levels of developer skills and more competitive labour markets. Some countries, like Kenya, are able to exploit niche markets, such as translation and language services. However, local and national gig economies are more likely to flourish in Africa as they capitalise on familiarity with local culture and practices.

Africa unlikely to make employment gains in manufacturing – must focus on innovation and human capital. A low-wage export-orientated development strategy is not available to African countries as they strive for middle income status. Robotics and its attendant change of the competitive advantage of nations have put paid to that. To achieve middle income status, African countries will have little choice but to follow the dictates of endogenous growth theory, which stresses the critical role of innovation and human capital. E-leadership and increasing levels of developer skills will thus become essential for African economies. The emerging sectors to focus on are services, the broader consumption-driven economy and digital agriculture. Two of our diagnostic countries – Kenya and Ghana – are bucking the trend with increasing contributions of agriculture to their GDP, both as a result of focused interventions mostly riding on digital rails. Africa's comparative advantage in agriculture, as well as the continental population explosion up to 2100, suggest that Africa should cultivate centres of excellence in digital agricultural technologies.

3. Skills for a digital economy

The previous section outlined how the digital economy is reshaping work. The dynamics in the future of work require a conceptual framework to identify the key skills that are required to access work opportunities in the future economy. In this section, we develop a skills framework to outline the key skills required to participate in the digital economy. The first subsection is a review of literature on skills from a broader perspective. We then review digital skills frameworks developed by the ITU, EU, World Bank and Co-Labs. In the second subsection we synthesise the existing approaches into our proposed framework of skills for work in the digital economy.

3.1. Literature review

3.1.1. Skills from a broader perspective

The process of developing a skills framework for a digital economy requires an understanding of broader skills frameworks. The starting point is the broader skills research commissioned by the Mastercard Foundation and conducted by Oxford Policy Management (OPM, 2019). This report therefore does not examine generic skills frameworks but uses the OPM work to contextualise digital skills.

Skills are acquired competencies. OPM defines skills as acquired capabilities with three characteristics: they are productive in nature, expandable and socially determined.

Skills are multidimensional. OPM's research underlines the multidimensional nature of skills. They distinguish three types or categories of skills: foundational, technical and transferable.

1. **Foundational skills** are the core skills young people require to accumulate technical skills for accessing job opportunities in the digital economy, such as literacy and numeracy[14].

14 Without the ability to read and write, a young person's ability to consume information or communicate digitally will be significantly impaired.

2. **Technical skills** are competencies required for job specific tasks, such as plumbing, driving and software programming. Digital skills are categorised as technical skills.
3. **Transferable skills** are applicable or portable across multiple spheres of life. They comprise personal socio-emotional attributes such as creativity, negotiation, communication and resilience under pressure. These skills are critical for young people to be successful in the digital economy (WEF, 2018).

In this section, we review four salient digital skills frameworks from the World Bank, ITU, EU and Co-Labs (Western Cape, South Africa). Building on these frameworks, we present our own digital skills framework, appropriate for the African continent.

3.1.2. The World Bank digital skills framework

The World Bank (2019) developed a digital skills framework as a market assessment tool to measure the level of digital skills in specific countries. They use a tiered typology of digital skills depicted in Figure 5 and assessed the supply and demand of each category of skills at a country level. The typology assumes skills progression across each tier, which is considered as a sliding scale from basic skills to advanced skills.

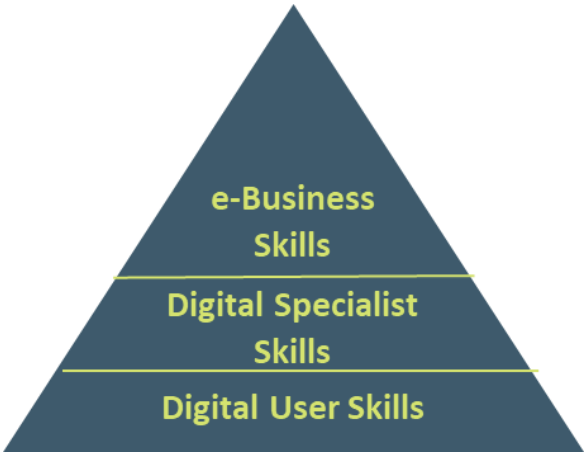


Figure 5: World Bank digital skills pyramid

Source: World Bank, 2019

The World Bank framework assumes that digital skills exist in a hierarchy:

1. ***Digital user skills*** are the foundational digital literacy skills needed to use basic digital tools and applications. This includes typing, word processing and web-browsing.
2. ***Digital specialist skills*** are the skills needed to develop, design, install and maintain digital tools and systems, and technology-enabled solutions. This includes web-design, software development, network administration, and research using big data and AI.
3. ***E-business skills*** are digital entrepreneurship skills that combine more advanced digital skills and business acumen to design new commercial products and services, or new business models based on technology, such as digital finance, blockchain and IoT.

3.1.3. International Telecommunication Union (ITU) digital skills framework

The ITU toolkit (2018)[15] provides a step-by-step guide for developing a national digital skills strategy. The framework was developed to provide policy guidance in response to research indicating that there will be approximately 500,000 unfilled IT jobs in Europe by 2020. The digital skills framework aims to assist policy makers in identifying priority areas and implementing appropriate interventions in their countries.

The ITU framework emphasises that digital skills exist on a continuum. The framework identifies digital skills within categories based on skills complexity. It groups digital skills into basic, intermediate and advanced:

1. ***Basic skills*** are foundational skills such as digital literacy, hardware knowledge and use, email, application use, managing privacy and word processing.
2. ***Intermediate skills*** encompass productive use of digital technologies for work, such as desktop publishing, digital graphic design and digital marketing.
3. ***Advanced skills*** are specialist skills required to work in ICT related professions, such as programming and

15 For more information on the ITU digital skills framework, see Chapter 2 in https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf.

network management, plus complex skills such as AI, big data, coding, cybersecurity, IoT and mobile app development.

3.1.4. European Union's digital competency framework

The EU developed a digital competency framework for citizens, called DigComp (2016)[16]. The aim of the new EU skills agenda is to ensure that all Europeans have a key set of competencies for personal development, social inclusion, active citizenship and employment in a digital society. The DigComp framework is designed to evaluate five competency areas:

1. ***Information and data literacy.*** The ability to obtain information, access online media, and move files.
2. ***Communication and collaboration.*** The ability to send and receive emails, conduct voice-over-IP calls, instant messaging, and upload self-created content to websites.
3. ***Digital content creation.*** The ability to create and move information within a document, use basic arithmetic formulae in a spreadsheet, create electronic presentations, create websites, and code in a computer programming language.
4. ***Safety.*** The ability to use and update IT security software, such as antivirus.
5. ***Problem solving.*** The ability to install new devices or software, modify the configuration parameters of applications, do an online course, order goods online, submit job applications, do internet banking, and make online appointments.

The DigComp framework applied across member states. To date, 28 EU member states have implemented the EU DigComp framework. The results from the skills test based on the DigComp framework feed into the EU's Digital Economy and Society Index (DESI)[17]. The index summarises the relevant indicators on Europe's digital performance and tracks the progress of member states in digital competitiveness. The latest DESI report (2019) indicates that

16 For more information on the EU's DigComp framework, see http://publications.jrc.ec.europa.eu/repository/bitstream/JRC101254/jrc101254_digcomp%202.0%20the%20digital%20competence%20framework%20for%20citizens.%20update%20phase%201.pdf

17 For more information on the EU's Digital Economy and Society Index, see https://ec.europa.eu/digital-single-market/en/desi.

in 2017, approximately 43% of the EU population have an insufficient level of digital skills.

3.1.5. University of Western Cape's CoLab Digital Skills Framework One

The Digital Skills Framework One (DSF One) was developed by Western Cape CoLab in South Africa. [18] It was designed to assist the provincial government in designing its policy on digital skills development. The Western Cape government aims to position the province as a leading digital hub. Therefore, a key part of the framework is to provide a summarised view of the digital skills relevant to the Western Cape region. The framework consists of four categories:

1. ***Digital literacy*** forms the foundation of the DSF One framework. CoLab defines it as the knowledge and skills relating to the use of computers and other digital devices. This includes the ability of individuals to use digital tools and facilities to perform tasks, solve problems, communicate, manage information, collaborate, create and share content, and build knowledge, in all areas of everyday life and for work. Digital literacy is the skills and knowledge necessary to build productive capabilities in the digital economy.
2. ***User digital skills*** enable higher efficiency for doing work in the formal sector. User digital skills are defined as being sector specific. For instance, the framework differentiates between digital skills required for working in the financial sector versus those required for working in the media sector. Examples of sector skills include mastery of key applications, and the ability to handle multiple media sources and formats which are relevant to the sector in question.
3. ***Practitioner skills*** relate specifically to doing work in the ICT sector. The primary difference between user digital skills and ICT practitioner skills is the outcome of the application of the skill. For user digital skills the outcome is the ability to conduct their work more efficiently through ICT, whereas for practitioner digital skills the outcome is an ICT artefact. For example, ICT practitioner skills include database design,

18 CoLab forms the Western Cape's point of presence and role-playing for the national e-skills programme under the auspices of the iKamva National e-Skill Institute. The team is closely associated with the University of Western Cape, South Africa. For more information see https://www.wcapecolab.org/about-us-1.

programming, systems design and software engineering.

4. ***Digital leadership skills*** are strategic in nature. Digital leadership or e-leadership skills relate to the capabilities required to seize opportunities provided by the digital sector. E-leadership skills include the capability to explore new ways in which business processes can be setup with digital technology or how to accomplish organisational goals through the application of ICT.

3.2. A skills framework for the digital economy

The four frameworks discussed above provide a representative sample of current digital skills frameworks. They also illustrate the two core functions these frameworks fulfil:

1. To assist in policy formulation for the development of digital skills. These frameworks operate at a higher or more aggregated level and tend to be outcome focused, answering the question: What must the skills enable citizens to do?
2. To describe the constituent competencies so that they can be taught, developed and measured. Only the DigComp framework falls in this category.

How does this framework differ? This report is intended to give guidance to policy makers and practitioners responsible for designing and delivering digital skill programmes for economic development specifically on: *Which skills do young people require to access work opportunities in the digital economy?* We therefore draw more on the frameworks for policy formulation. We find the distinction between three different categories of skills (excluding e-leadership skills) as elaborated in the ITU and CoLab more useful than the World Bank distinction between two categories, since it better reflects that actual function of individuals in the economy. Given the substantial gap between the state of development of the digital economy in SSA and that of most of the rest of the world, we propose that it is important to include an expanded category of e-leadership skills, being required to provide innovation and digital leadership in both the private sector and the public sector. We then include specific competencies based on the DigComp framework under each category of skills to make it practical and tangible. We took the liberty of elaborating skills beyond just the citizen focus of DigComp.

To deliver the four outcomes also requires complementary skills, specifically foundational skills and socio-emotional skills. Figure 6 depicts digital skills as part of the larger skills framework for the digital economy.

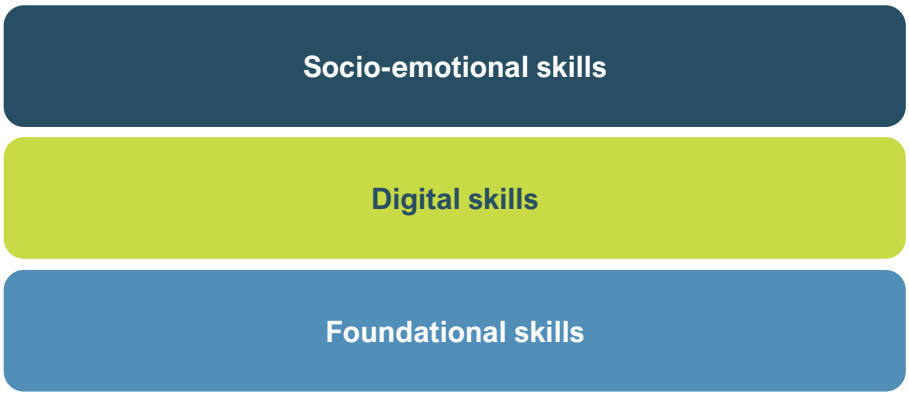


Figure 6: Three categories of the skills framework for the digital economy

A skills framework for the digital economy[19]. The full framework of skills for a digital economy is illustrated in Figure 7. The four categories of digital skills are enabled by foundational skills. Socio-emotional skills (often referred to as soft skills) condition the application of digital skills. The heart of the framework consists of digital skills. These are divided into four outcomes (the columns) and five competencies (the rows). The cells in the framework include digital skills examples from our literature review and stakeholder engagements.

Progression of competency within the cells of the framework. The level of complexity of digital skills is not captured in the rows or columns of the framework. All developer skills are not necessarily more complex than all productive skills. Similarly, all content creation-type skills are not necessarily more complex than all digital interaction-type skills. However, within each cell, different levels of complexity can exist. For example, one individual may have a higher level of competency in consumer skills than another.

19 Even though the skills framework for a digital economy was not initially designed as a measurement tool, it can be used as a reference framework for a digital skills test. A separate report – Tech Savvy – contains the insights from an experimental test conducted in Kibera, Kenya and was based on the skills for a digital economy as described here. For more information see Tech savvy: Skills for the digital economy. This report contains the methodology used for the test.

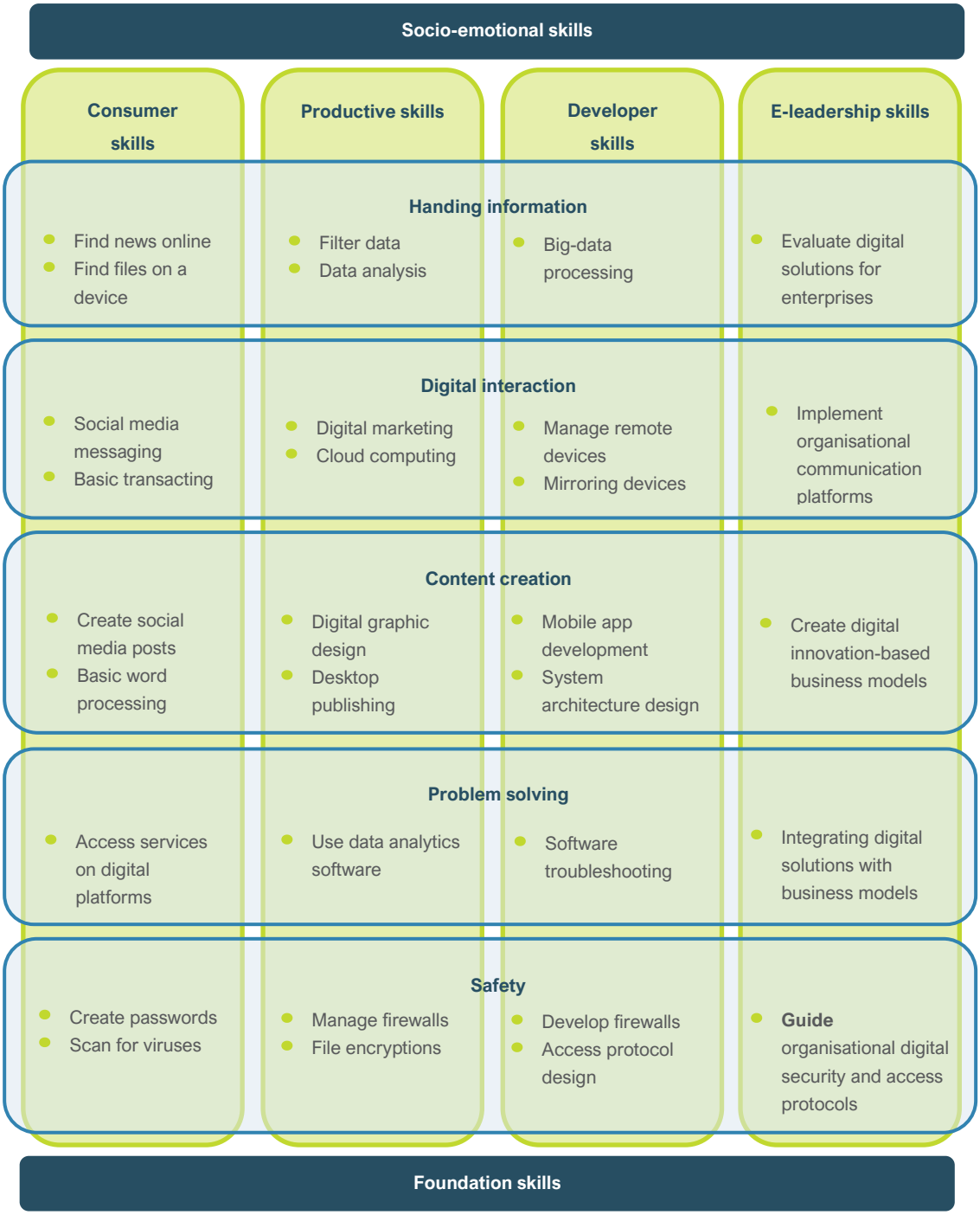


Figure 7: Skills for a digital economy framework

Source: Author's own

3.2.1. Consumer digital skills

Consumer skills are the capabilities that individuals need to function socially, economically and politically in a digital society. They enable the individual to be an effective consumer and citizen in the digital economy.

Examples of consumer skills across the five competency areas are as follows:

1. ***Handling information.*** Browsing the internet to consume information, whether it is news articles or commercial deals. According to the WEF (2019), 3.8 million Google searches are made every minute globally.
2. ***Digital interaction.*** Online social media is the new way humans interact with one another. Africa currently has 191 million active social media users, increasing by 12% each year (Hootsuite, 2018).
3. ***Content creation.*** Creating and sharing media, such as photos, videos or blogs, is a new form of how individuals share information and experiences.
4. ***Problem solving.*** Individuals need the ability to locate, download and troubleshoot the usage of applications to benefit from the efficiencies that digital technology offers. The WEF (2019) calculates that 390,030 apps are downloaded per minute.
5. ***Safety.*** As people live greater portions of their lives digitally, online security becomes a higher priority. The ability to create passwords and understand the concept of terms and conditions are important skills. The experimental test that formed part of our primary research showed that digital skills relating to digital safety are lowest[20].

3.2.2. Productive digital skills

Productive skills are the skills that individuals require to apply existing digital technologies for productive purposes. Productive skills enable individuals to use digital technologies to facilitate the production or the exchange of digital goods. These are the key skills required to be an effective employee or entrepreneur in the digital economy. Examples of productive skills across the five competency areas are as follows:

1. ***Handling information.*** The basic ability to extract and interpret online information in a work environment that utilises digital technologies, including the ability to work with financial information in spreadsheets.

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20 For more information, see Section 4 of the Tech Savvy report. The average mark for questions relating to digital safety was 38%.

2. ***Digital interaction.*** Digital technology presents new modes for individuals to productively engage with one another, for instance, sending professional communication via email, marketing on digital platforms, and cloud computing, which is an essential skill in order to work with people in different locations. According to IFC (2019), 65% of job opportunities filled at African companies in the past year required basic productive digital skills of this nature.
3. ***Content creation***. Examples of content creation includes creating online professional profiles, PowerPoint presentations, database creation, word processing skills and creating digital marketing materials. In 2019, consumers spent almost USD1 million on e-commerce platforms per minute globally, an annual increase of 15% (WEF, 2019). In order to drive consumers to e-commerce platforms, digital marketers require the ability to create high-quality advertising content through digital graphic design.
4. ***Problem solving.*** Problem solving pertains to the skill to identify digital tools to increase productivity and find online solutions to deal with problems relating to digital tools, for instance, using Evernote to optimise note taking, storage and sharing. The digital economy brings a world of work that will be increasingly digital. For young people to be competitive, they need the ability to find the digital solutions for productive problems.
5. ***Safety.*** With the risk of cybercrime increasing, individuals need to be able to safeguard the digital goods and service they produce. For example, in a productive capacity, digital workers need the ability to activate and manage firewalls or encrypt files that are only meant for certain users.

3.2.3. Developer digital skills

Developer skills are the skills required to develop, customise or modify digital technologies and digital infrastructure. There are two levels of skills in this category: (1) the skills to develop entirely new digital technologies or infrastructure, for example, a new coding language or new storage technology; and (2) the skills to apply existing technologies to create new applications for productive or recreational use.

These skills form the core of the skillset young people need to shape the digital technologies that will impact their

futures. Examples of developer skills across the five competency areas are as follows:

1. ***Handling information.*** Examples include big-data processing and data science skills. The digital sector is growing. As individuals download more applications and make more online transactions, more data becomes available. The Raconteur (2019) estimates that in 2020 the accumulated digital universe of data will consist of 44 Zettabytes[21].
2. ***Digital interaction.*** Remote monitoring and management of devices and servers will become an important skill as an increased amount of human interaction becomes remote and via digital channels.
3. ***Content creation.*** As the digital economy grows, the demand for software applications and the need for systems architecture will grow accordingly. Therefore, the ability to use code to create software applications and build digital architecture for systems will be skills in high demand.
4. ***Problem solving.*** IT system troubleshooting and bug resolution skills will be in increasing demand as digital systems become more pervasive and complex.
5. ***Safety.*** Cybersecurity Ventures (2017) estimates that cybercrime will cost the world approximately USD6 trillion by 2021. The ability to develop security software, such as antivirus programs or designing access control protocols, will be increasingly in demand to protect the four billion people and fifty billion devices that will connect to the internet by 2020 (Microsoft, 2016).

3.2.4. E-leadership skills

E-leadership skills are the skills required to conceive and execute business models to deliver public or private goods utilising digital technologies. These skills are strategic in nature. They speak to leading innovation in both the private and public sectors. E-leadership skills consist of competencies that combine an understanding of technology with acumen to develop and implement business models and systems for productive use or public policy implementation. Individuals with e-leadership skills do not necessarily have to possess advanced developer skills but possess the ability to provide strategic leadership in digital markets. They create

21 One Zettabyte equals $1{,}000^7$ bytes; or 1 billion terabytes.

opportunities for others. Examples of e-leadership skills across the five competency areas are as follows:

- ***Handling information.*** This pertains to the ability to identify and evaluate multiple, and sometimes competing, digital technologies to determine their usefulness in solving a particular business or public sector problem, for example, which digital payment solution is most appropriate for which type of public transport type. Furthermore, it is about understanding how a specific digital technology will create value for customers or citizens.
- ***Digital interaction.*** The skills and vision to understand how to structure digital interaction within an organisation. This includes interacting with seniors, peers, sub-ordinates and the external environment through digital channels. For example, e-leadership skills are about understanding which digital channel is the best at reaching a client target market, or the ability to maintain a presence and interact with peers on leadership platforms in strategic dialogue.
- ***Content creation.*** To identify and direct the development of appropriate digital technologies to execute the mandate of the innovator; that is, to guide and shape the technological solution to speak to the need of the client or citizen. For example, in the private sector, it is about shaping the development of digital business solutions such as the integration of digital payments. In the public sector, it is about directing e-government solutions, such as online tax submissions or online applications for documents.
- ***Problem solving.*** The ability to overcome the technological and business model obstacles. Someone with e-leadership skills does not necessarily have the technical skills to overcome the problem but would have the competency to give guidance. For instance, if there is a digital systems failure at a financial institution, e-leaders have an understanding of how alternative solutions can prevent the failure of service provision.
- ***Safety.*** E-leaders play a vital role in managing risks in the digital sector. These risks manifest at an institutional, personnel and digital asset level. With the risk of cybercrime increasingly dramatically in the digital age, e-leadership skills are necessary to mitigate these risks. Without these skills, countries and institutions will be vulnerable to nefarious third parties.

3.3. Skills for different devices

Mobile leading adoption race in Africa. The market share of devices in Africa has changed dramatically in the past six years. In January 2013, computers dominated the market with 83% of the sales value with mobile devices only accounting for 15% of the total market share. By August 2019, the market share of computers had declined to 36%, with the mobile devices increasing to 61%. Figure 8 illustrates the changes in market share for the past six years.

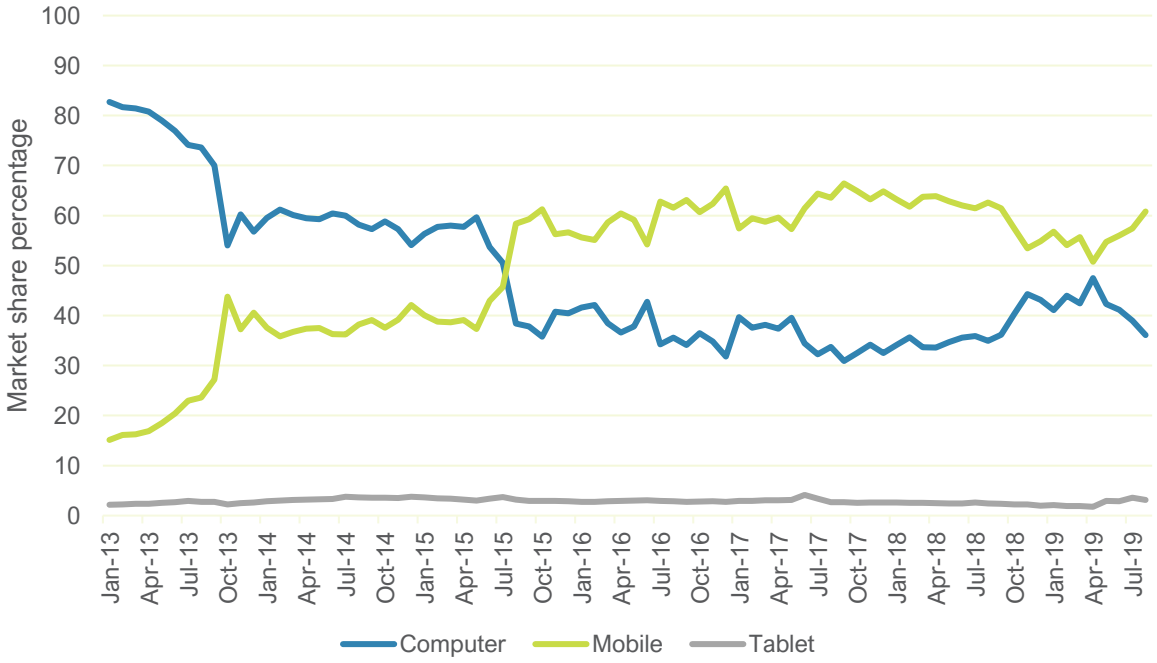

Figure 8: Market share of devices in Africa

Source: Statcounter, 2019

Internet usage mostly from mobile phones. Unsurprisingly, considering Figure 8, internet usage from mobile phones has surpassed computer internet usage. In 2015, just over half (52%) of global internet users accessed the internet from mobile devices. In 2019, it was almost 80%. Website traffic tells a similar story. In 2018, 52% of all website traffic was generated from mobile devices. In Africa, the mobile's share of website traffic is slightly higher at 60%.

Different digital devices are suited for different types of activities. Not all devices are equal. Mobile devices have become a port for individuals to the internet. However, this does not necessarily enable them to access the digital economy productively. Mobile devices are better suited for activities that relate to consumer outcomes, such as reading

information, instant messaging, social media engagement and transacting on e-commerce platforms (Correa, Pavez and Contreras, 2018). Computers are more suited for activities that relate to productive and developer outcomes. Word processing, data analysis, creating digital marketing content and developing software are more convenient and efficient to do on a computer. Evidence from the primary research contained in Tech savvy: Skills for the digital economy substantiates this finding[22]. However, the primary research also showed that smartphone applications are extensively used for business purposes, especially in the informal sector.

3.4. Conclusion

The skills framework for a digital economy most relevant for an African context. The skills framework as conceptualised in this section – specifically section 3.2 – deliberately takes the African context into account. With 86% of the African workforce employed in the informal sector, the skills categories must be applicable across formal and informal economic domains. The skills for a digital economy place sufficient emphasis on skills that are necessary for accessing economic opportunities in the informal sector. Therefore, it is the most appropriate framework for an African context. Furthermore, the framework can be used as the basis for digital skills measurement indicators. The competency areas of the framework have its origins in the EU DigComp framework, which has been used in studies to measure digital skills in Europe.

More than digital skills are required to access opportunities in the digital economy. The skills framework for a digital economy takes into account a broader set of skills than digital. Even though the growth of the digital economy and the pervasiveness of digital technologies will require more and enhanced digital skills, other skills such as foundational and socio-emotive skills remain relevant. Foundational skills are key to learn and develop further skills.

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22 The digital skills assessment exercise used in the qualitative research consisted of activities that required a mix of consumer and productive skills. Our cases studies describe some of the challenges of using mobile phones for productive tasks. One of the participants, Alfao, had to use his mobile phone to do his university assignments because he could not afford the internet café rates. However, Alfao still needed to finalise his assignments at the internet café after doing most of his work from a mobile phone since his ability to edit and format his work on his mobile device was greatly restricted. This points to the need for appropriate devices in order for people to access economic opportunities in the digital economy.

In a world still dominated by humans, socio-emotive skills are necessary for successfully interacting with other individuals in environments where economic opportunities exist.

Digital skills is an enabler of consumption and production in the digital economy. As digital technologies become more integrated in the lives of humans, digital skills are not only necessary to be productive, create new technologies and build digital business models. They will also become necessary to consume privately and publicly provided goods and services. Without digital skills, individuals will become economically, socially and politically excluded.

Mobile devices are most common, but have a ceiling for more productive activities. Mobile devices are the most prevalent on the African continent. They tend to be cheaper than computers and the infrastructural requirements, for example electricity, for mobile devices are lower. However, the functionality of mobile devices is less than that of computers. In a context in which most people are working in the informal sector, the mobile device is sufficient for the majority of economic activities. For more sophisticated activities, workers will require a computer.

4. Learning for a digital economy

How do young people in Africa learn skills for a digital economy? In order to understand the supply of digital skills, we first need to understand the context in which these skills are learned. Using our digital skills framework, we examine the different modes of learning for a digital economy to unpack how consumer skills are learned, the approaches for delivering content to build productive and developer skills and finally, the ways in which e-leadership skills can grow.

In this section, we first provide an overview of the important factors affecting learning in Africa to provide context. Then we outline the different technical learning approaches that can boost learning outcomes. Finally, we provide a typology for the different modes of digital skills delivery and attempt to categorise these in terms of cost, scale and employability.

4.1. Contextual factors that impact learning in Africa

High inequalities in education systems. Educational institutions in Africa struggle to equip students with the skills required to be effective employees in the job market. Although school attendance and overall literacy rates have improved significantly since 1970, children are still not finishing school with foundational skills. This is especially true for children from low-income households, minority ethnic groups and religious communities, and even more so for girl children (UIS UNESCO, 2017). Furthermore, there is a stark contrast between public and private school systems. Instead of providing a bridge to overcome inequality, such an education system can serve to further entrench structural inequality.

Too little access, low educational outcomes. Africa has the lowest rates of pre-school access and the highest rates of children out of school or who drop out. Even those who do attend school are not guaranteed an education. According to UIS, 61% of youth will not achieve the minimum levels in reading and mathematics by the time they complete school. This lack of foundational skills acts as a barrier to developing other skills for future employment, such as digital skills. “Despite years of steady growth in enrolment rates, the education situation in SSA continues to threaten the future of entire generations” (UIS, UNESCO 2017).

Low quality schooling. According to the 2018 World Development Report, the quality of public-school education in Africa constitutes an education crisis. In 14 SSA countries, the average Grade 6 teacher performs no better on reading tests than do the highest-performing students from that grade (World Bank, 2018). Although data varies from country to country, most educational systems in SSA are characterised by poor service delivery, unskilled and unmotivated teachers, high student-teacher ratios, insufficient infrastructure and weak school management (World Bank, 2018).

'One size fits all' approach exacerbating inequalities. Even through it is well documented that students learn at different speeds, teaching continues to be characterised by the grade system. This puts slower students at a disadvantage as they are left behind. Large class sizes make it difficult for teachers to notice or assist such students. Targeted teaching, with similar performance level groups of students, can be effective in improving students' performance but is rarely applied in African public schools.

Rote learning practices not delivering skills for future jobs. Learning approaches that focus on passive memorisation and repetition do not prepare young people for the future job market. Approaches that cultivate socio-emotional skills such as curiosity, problem solving, collaboration and communication remain underutilised. Such skills are increasingly important for the future as they give humans a competitive advantage over automated systems and are critical for the effective application of digital skills. In the face of such challenges, ensuring quality outcomes-based learning, even in reading and mathematics, is a struggle. The results are stark: in SSA, fewer than 7% of students in late primary school are proficient in reading and only 14% are proficient in mathematics (Brookings, 2018).

Is technology the solution? Ed-Tech has significant potential to bridge the learning gaps by providing up-to-date, high quality and interactive content, which can be scaled to many students. Ed-Tech covers many forms, from personalised learning apps to standardised curriculum-based content and MOOCs. Tech-assisted learning can be used to build mastery of both foundational and digital skills. It can also supplement classroom-based education, providing additional learning content for 'at home' or distant learning, where a student has access to a smartphone or other hardware.

Box 1: A review of the evidence on Ed-Tech

The current evidence on the success of Ed-Tech is very mixed. A recent meta-analysis on the impact of technology on educational outcomes in OECD and US schools provides some useful evidence (J-PAL, 2019). Technology is not successful at replacing teachers, nor can it improve outcomes by simply digitising and scaling ineffective teaching methods.
The evidence also highlights that an over-reliance on technology leads to declining performance, as measured by test scores. Optimal use of computers for classroom learning is 10–30 minutes per day for non-ICT subjects (J-PAL, 2019). Furthermore, high investment in technology may lead to trade-offs in expenditure with consequences on other resources, such as textbooks.

However, two promising approaches are backed by the evidence. Firstly, technology can boost student achievements when combined with classroom teachers who can provide support and encouragement to students (blended learning). Secondly, computer-assisted learning shows “enormous promise” by tailoring content to a student’s knowledge level and setting progressively harder problems, especially in mathematics (J-PAL, 2019).
Given the disparity in at-home access, technology in school can also provide equity in digital learning opportunities for all students, regardless of socio-economic, ethnic or religious background (Brookings, 2019).

Teaching students the cognitive skills to navigate digital content and assess and select appropriate materials is also key to successfully leveraging technology for learning. Furthermore, providing opportunities for students to create, and not only consume, digital content, enhances creativity and their agency in the process. Critical to successful Ed-Tech is an understanding that technology is the *means of delivery*. It is the content and teaching methods, digitally repurposed, that matter most for learning outcomes.

Summary of evidence on digital skills learning approaches

Some tech is better than none: students reporting low to moderate use of tech in class achieved higher test scores than those with high usage (Reboot Foundation, 2019).

Think pedagogy first, technology second. The teaching approaches matter more than the technology. Technology will amplify the teaching method, so if tech is used to scale ineffective instructional learning, results will not follow, but in the hands of good teachers it is effective (Brown Centre Chalkboard, 2019; InfoDev, 2019).

Blended learning is an approach that combines supportive in-person classroom group teaching, supplemented with technology, to generate positive learning outcomes (Brown Centre Chalkboard, 2019; InfoDev, 2019; J-Pal, 2019).

Necessary but not sufficient: access to ICT does not guarantee learning outcomes. Device distribution is costly and without appropriate teaching methods and content, will risk failure (Lessons from One Laptop per Child and Kenya's Digital Literacy Programme).

Tech-assisted learning show enormous promise: tech-enabled personalised learning can allow students to work at their own pace, within one classroom. Significant results were noted in mathematics
(J-Pal, 2019).

Figure 9: Best learning approaches with technology

4.2. Teaching methodologies for technical skills

The following five approaches to teaching technical skill can raise the quality of learning outcomes and youth employability. Those that include a variety of learning styles, such as hands-on and participatory experiences, are noted for increasing results.

Problem-based learning. Uses real-world problems as a way to explore an issue in small groups. Builds skills in critical thinking, collaboration and communication. Allows for questioning and experimentation to solve the problem.

Work-based learning. Puts theoretical learning into practice through workplace experiences, through exposure visits, internships, job shadowing or simulations. Could boost employability through practical experience of a work-setting.

Blended learning. Makes use of both digital and face-to-face teaching time. Also referred to as 'flipped classroom', as classroom time is used for discussions and hands on projects, while lectures are watched at home (or online in the classroom). It allows for self-paced work but continues to provide in-person support and guidance from teachers.

Tailored learning. The pace and complexity of the content is tailored to the student's needs. Retention is improved as students can work at their own speed. Computer software can be used to create customised content for each student.

Online learning. MOOCs or other short courses (including informal courses on YouTube) where users can choose not only the topic, but when and where they learn. However, fully online courses suffer from very low completion rates.

4.3. Challenges unique to teaching digital skills

A number of challenges exist for teaching digital skills, which differ from general educational challenges in Africa.

Infrastructure. Electricity is a fundamental challenge, especially for primary schools and schools in rural areas. Although some solar power solutions are available, they are not widely invested in for public schooling. Furthermore, a connection does not guarantee a supply, given the common problem of power cuts and shortages in developing countries. Without regular back up or battery power, students may risks losing their work, resulting in a disincentive for both teachers and students to use technology to create content. Buildings sufficient for housing technology securely are not always available, for example with metal doors and windows that can be locked.

Internet. Although mobile internet is now widely available, the cost of data remains too high for this to be a viable option for school-based learning or for self-learning. An increasing number of secondary schools do have some internet access for pedagogical use, but again being connected does not guarantee access. Some devices come pre-loaded with educational content and are thus offline during class time but would still need to be connected regularly for updates and downloading new content. Conversely, access to the internet poses a different challenge, one of distraction and viewing inappropriate content.

Hardware. Digital skills are practical skills, and so learning requires access to hardware. Whether via tablet, smartphone or computer, students need to practice and interact with technology. Hardware may also include audio-visual equipment. Challenges lie not only in the acquisition of the hardware, but also storage, maintenance, upgrades and security. Furthermore, the risk of theft is a challenge that can

sometimes result in hardware being kept locked away and underutilised for fear of it being stolen.

Foundational skills. Being able to read, spell and understand numbers is fundamental for digital skills. Given the low levels of learning outcomes outlined above, this poses a challenge for learning digital skills. However, it is important to note that technology can be used to address this issue. A wide range of Ed-Tech apps use visuals and gamified approaches to teach foundational skills.

Digital literacy among teachers. Not all teachers possess the necessary skills to use digital devices themselves. This is not only a challenge for teaching students how to use technology and solve problems, but also for understanding what students are doing. This is a challenge that will most likely decrease over time. In some countries, this issue is addressed by using the more tech-savvy students in the classroom to demonstrate or assist the teacher.

Integrating technology into lessons. Using technology for learning in non-ICT subjects requires relevant content and appropriate teaching methods that are student-centred as opposed to traditional direct teaching methods. Not all teachers are comfortable or prepared to let go of their preferred teaching methods, particularly where a teacher is in full control. Furthermore, not all technology is beneficial for learning outcomes and there are limits as to how much time students should spend on a screen, particularly given that humans are better able to read and absorb information on paper, and that students learn through physical activities and interactions.

Insufficient Computer Science teachers. The lack of skilled Computer Science teachers and ICT teachers in general is a global challenge. In the UK, Computer Science is officially the hardest subject to recruit for, with only two-thirds of places filled in 2018 (UK Education Policy Institute, 2017) and in 2017, only 36 teachers graduated from universities with Computer Science degrees in the USA, compared with 11,157 Mathematics teachers (code.org, 2018). The World Bank estimates that Ghana's ICT teaching gap is 140,000 teachers (2018). Too frequently, digital skills training for teachers focuses on basic digital literacy, and not on upskilling in ICT.

4.4. Assessment of digital skill learning channels

There are a wide variety of ways for young people to learn digital skills. In order to understand what works and the relative merits of different approaches, we developed a typology of learning modes. After scanning 126 initiatives from 24 countries across Africa, Asia and Latin America, we were able to create categories to organise and assess the different approaches. The methodology and results are outlined here. The full scan is documented in Appendix 0.

Digital skill learning typology

To develop a digital skill learning typology, we created a framework to categorise initiatives based on the five emergent delivery modes: self-learning, formal education, dedicated skills providers, employers and entrepreneurs, and product induction.

We then considered whether a learning mode was regulated by a formal curriculum or not. We acknowledge that one mode could deliver training across multiple types of digital skills, thus we did not use the digital skills framework as a basis for categorisation, but rather for assessment.

Assessment criteria used

We assessed each type of initiative based on three dimensions:

1. **Digital skills training**: consumer, productive, developer, e-leadership skills
2. Foundational and socio-emotional skills training
3. **Functionality**: scale, cost and employability.

Given the Mastercard Foundation's goal of enabling 30 million young people in Africa to secure employment, criteria of cost, scale and employability are crucial. The key insights on these three factors are outlined in the conclusion. From our research we know that foundational and socio-emotional skills are indispensable for building youth skilled for a digital world. Thus, these aspects were important to include alongside the four levels of digital skills.

Due to the high number of specific programmes reviewed, the assessment was completed against each generic sub-type. Examples of individual successful programmes are detailed below.

In the next section we unpack the five learning typologies, according to the criteria.

4.4.1. Self-learning

What is it? This includes *self-learning* through online content such as videos and learning apps, and *family and friends* who can coach or demonstrate how to do something. From our stakeholder interviews, self-learning was strongly represented, especially in the informal sector and through self-taught entrepreneurs (productive skills). YouTube and other online learning channels provide a way for youth to learn about almost anything. However, there is a division between those who already know how to navigate digitally and can access learning opportunities, and those who cannot. For the latter, having someone to show them basic consumer-level digital skills and build their confidence in using technology is an important first step, opening the way for further exploration and learning by doing. This is the role of a digital broker, such as skilled staff at a digital learning centre or other intermediary.

Potential benefits. Self-learning has the advantage of being self-paced and students can choose when and how to learn. The internet can be a gateway to unlimited and equitable learning opportunities. YouTube is easily accessible and for more substantial content, many MOOCs are available at no cost (without certification). Free learning-specific apps are widely available.

Challenges. Self-learning does require significant self-motivation and time-management skills, as well as basic literacy skills to navigate (even if learning content is available as video). Not all young people are equipped with these personal skills. Evidence shows that for high-performing students, self-learning is as effective as teacher-led learning (Leddo et al, 2017). However, average students tend to benefit more from teacher-led learning models. This shows that initiatives focusing only on distributing devices to students will have limited impact in building digital skills, if not combined with in-person support and guidance.

Access and cost issues. In Africa, access to both internet and devices are still barriers to scaling self-learning methods. According to the World Bank Development Indicators (2017), households with access to the internet remain low, but official statistics do not take into account access to the internet via mobile devices, which is growing rapidly and is the dominant means of access in Africa. Despite this, the cost of self-directed learning remains high

due to the cost of data. In 15 African countries, a gigabyte of data costs more than 10% of average monthly income (A4AI, 2019). According to EdX (2013), an online learning site, the optimal length of an educational video is 10 minutes. If ten videos are required to complete a course, the cost of data makes learning in this way unaffordable. Furthermore, few are able to use this learning to gain formal employment, without paid-for certification or recognition of online course (NORRAG, 2018).

Opportunities. Self-learning can boost opportunities and growth in the informal sector, as documented in our primary research and country diagnostics. There is a case for providing public WiFi access at hubs or community centres to enable self-learning. Devices pre-loaded with learning materials and then used offline provide an appropriate solution for youth in Africa. Further impact can be generated where a trained agent or digital broker can encourage, support and guide young people to navigate to learning sites. The agent method is used in India coach women in digital literacy[23].

Assessment of self-learning

Strong: consumer skills, low cost, employment in informal sector

Medium: scalable, productive skills

Weak: formal sector employment (unless certified), soft skills, foundational skills (unless an app to learn this), developer skills, e-leadership skills.

4.4.2. Formal education

Introduction. In terms of scale, the teaching of digital skills through the formal education system is unparalleled. Public education systems have the potential to reach every child in a country. Many curricula now include ICT at secondary school, if not at primary, and most universities globally offer at least one course in Computer Science. In formal education, we included pre-primary through to tertiary education, including Technical, Vocational and Education Training (TVET) colleges as well as universities. From our scan, digital skills are mostly taught at secondary and tertiary

23 https://internetsaathiindia.org/ supported by Google and Tata.

level, although a growing number of countries now include it in the primary curriculum.

Primary schools key for an equitable start. Huge gains have been made in universal education for boys and girls, in all countries, at primary level. However, this has contributed in part to the crisis in education (more students without additional resources). Despite this, primary schools offer the greatest entry point for equity in teaching digital skills. A significant number of countries have achieved gender parity in primary education, with high levels of attendance. For a variety of reasons, far fewer children are enrolled at secondary level, and a gender gap appears. Thus, interventions for teaching digital skills at primary level can achieve the broadest reach.

Two strategies for teaching digital skills. From our initiatives scan, we see two strategies emerging in the implementation of digital skills within schooling systems: firstly, ICT lessons within the curriculum, and secondly the integration of digital technologies in delivery of the (non-ICT) curriculum. However, in low-income countries both approaches have had limited impact due to operational and pedogeological challenges. This includes challenges created by insufficiently trained teachers, no classroom to use as a dedicated computer lab, a lack of hardware, and schools that do not have electricity or internet connection. However, these challenges are not insurmountable and a number of innovative solutions (albeit still on a small scale) are available on the continent.

Still learning despite challenges. The formal education system still provides the most scalable and equitable way to teach digital skills, if the quality can be raised. In most cases, basic consumer digital skills are still taught in the absence of computers, using textbooks and chalkboards. Inadequate access to devices limits the ability of students to apply digital skills practically and to learn productive-level skills. Developer skills are usually taught when students specialise in Computer Science at secondary school or more commonly at university. However, uptake of Computer Science as a specialisation among students in Africa remains low. For instance, in Kenya, only 2% specialise in Computer Science at secondary school while only 10% of students graduate in any STEM-related fields at tertiary stage. Broadening the curriculum for ICT beyond Computer Science, and making it compulsory, can influence diversity in the tech sector. Females who try Computer Science at high school are ten times more likely to major in it, and black and

Latino students are seven times more likely (Code.org, 2019).

Standardising digital skills. Globally, digital skills integration in school curricula aim to provide students with consumer digital skills at a minimum. For example, most European countries have made significant progress by implementing the European Computer Driving Licence (ECDL) programme as part of final school examinations. The ECDL curriculum covers the 21 competence areas outlined in the EU digital competence framework. Around 800 secondary schools in the UK use the ECDL programme to certify proficiency in digital skills with the intention of enabling students to attain an accepted standard of digital literacy. The use of a standardised curriculum that covers consumer and basic productive skills, provides school leavers with a solid base for learning higher-end developer skills. ICDL provides an international version of accreditation, with over 24,000 accredited test centres globally.

Coding at primary? The UK government is one of 15 EU states to have embedded coding in its national curriculum, and one of only nine members states to have done so at primary level. The list of non-EU countries preparing to introduce coding at primary school includes Japan and South Africa. However, debate continues among OECD countries as to whether this is a valuable investment. Currently in the EU, Computer Science is the hardest subject to recruit for. Thus, the shortage of supply in skilled ICT jobs affects not only the private sector but also the public teaching sector[24].

A framework for using technology in schools. While a standardised curriculum on digital skills is still lacking in Africa, there has been consensus on the digital skills competencies required for teachers (UNESCO, 2018). Most African governments have adopted the ICT competency framework for teachers, which covers the skills needed to utilise technology in a classroom setting. This provides a good starting point for teachers to deliver learning in consumer and some basic productive skills. However, the UNESCO framework does cover the skills required to deliver Computer Science teaching for developer skills.

Teaching ICT in Africa. Half of the countries in Africa currently do not have computer skills in their curriculum, compared with 85% globally (IFC, 2019). However, our scan

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24 https://edtechnology.co.uk/Article/what-is-the-code-for-success/

of education systems in Africa has shown that some governments are committed to closing the digital gap, including Kenya, Ghana and Senegal (see country diagnostics below). The South African government has launched a Presidential Commission on 4IR, which includes a digital skills focus: new curriculum subjects in coding and robotics (among other new STEM subjects), training 72,000 teachers in coding and a partnership with Google, Teen Geeks and other businesses to develop a platform to customise teaching and learning, and using AI and machine learning. Implementation in the pilot phase will cover 1,000 schools across five provinces[25].

Device distribution only mostly fails. The solution to digital skills is often seen in terms of hardware. However, approaches that focus on device distribution rather than content and teaching methods have often been very expensive, with limited results and little sustainability. Kenya's Digital Literacy Programme, which distributes devices, has been costly and with limited results to date. However, the long-term gains and improvements in implementation and training may be achieved in Phase 2. Further lessons can be drawn from Rwanda's decade-long experience with the One Laptop per Child initiative, which collapsed because of inequitable access to devices across the country[26] that left particularly rural children excluded. It remains to be seen if Rwanda's Smart School approach will fall prey to the same challenges of focusing on hardware, or if efforts will be made to integrate changes in teaching and learning approaches[27].

South-Asian experience. More effective models on providing technology can be drawn from Bangladesh, which focused on establishing 1,500 learning centres across the country. This effectively met the needs of approximately 200,000 students from refugee settlements. The Indian state of Kerala also provides a more successful example. The Kerala Infrastructure and Technology for Education (KITE) embedded digital technologies and IT clubs across 4,572 schools, reaching 1.6 million students per year. Here too though, implementation challenges constrain outcomes, as many school buildings are not able to house tech equipment

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25 https://businesstech.co.za/news/technology/310776/south-african-schools-will-soon-get-these-8-new-subjects-including-coding/

26 https://www.heart-resources.org/wp-content/uploads/2018/04/A-scoping-study-transforming-education-through-technology.pdf

27 https://www.researchgate.net/publication/223542206_Introducing_ICT_into_schools_in_Rwanda_Educational_challenges_and_opportunities

because they lack electricity and secure metal door and window frames.

Digital skills at university. Tertiary education is an important channel for the delivery of both productive and developer digital skills at scale. University degrees remain highly desirable for employers because of accreditation and acceptance in the labour market (NORAG, 2018). However, universities across Africa experience many challenges in producing job-ready graduates. For example, universities increased enrolment without substantial improvements in infrastructure and capacity, with a negative impact on results (Brookings Institute, 2018). The British Council (2016) noted that undergraduate classes in Kenya can have as many as 500 students, resulting in adverse learning outcomes. A further challenge is university bureaucracy, where curricula can take several years to update, resulting in outdated content being taught. The IFC (2019) estimates that as much as half of the content of first year undergraduate course will be outdated by the time students finish the four-year course. This further exacerbates the gap between industry requirements and the skills set possessed by graduates. However, there are notable exceptions on the continent, including Strathmore University (Kenya), Ashesi University (Ghana) and the African Leadership University (Rwanda and Mauritius).

Opportunities. Formal education provides the best entry point for scale and equitable access to digital skills. There are opportunities for young people to learn digital skills directly in ICT lessons or through using technology embedded in classroom learning of core subjects. The latter will reach the highest numbers of students but will not address the looming skills gap in ICT. However, the distribution of hardware alone will not lead to the desired outcomes, without changes to the teaching methods and updating of the curriculum.

Assessment of formal education

Primary: strongest on scale and foundational skills. Low employability and minimal learning in digital skills categories (at present).

Secondary: strong on scale and cost, as well as foundational skills, while also developing a degree of socio-emotional skills, consumer skills and some productive skills.

Tertiary: strongest on employability, building socio-emotional skills alongside productive, developer and e-leadership skills. However, cost is higher.

4.4.3. Dedicated skills providers

Introduction. Coding academies and digital skills training institutes have grown rapidly to meet the demand for highly skilled developers and ICT staff. In Africa, since many young people leave school with few digital skills, a large number of private learning centres have sought to close this gap. These dedicated skills providers teach courses that range from basic word processing to advanced programming languages, taking from three days to 12 months to complete. Teaching typically uses blended learning approaches to deliver digital skills, a mix of classroom-based and online. Some courses are delivered through intensive short-term 'boot camps' or are fully online. Many institutions do not have the same regulatory oversight as formal education providers and their incentive to deliver digital skills vary, but the quality of education they provide is closely tied to their viability.

Fully online courses. Massive open online courses are often seen as a panacea for delivering quality content for consumer and productive digital skills at scale. However, effectiveness is limited by high attrition rates. About 52% of registrants do not access course materials and as few as 7% attain certification (Reich and Ruiperez-Valiente, 2019). Our key informant interviews also revealed that completion rates on MOOCs focusing on digital skills are as low as 2%. Thus, we see that MOOCs fail to achieve scale, even though initial uptake is usually high.

Classroom-based courses. For the delivery of producer and developer digital skills content, classroom-based teaching or blended learning have shown to be the strongest approach for employability. Success factors include:

- Curriculum is purposed for industry demand and regularly updated
- Industry links: practitioners as trainers, work environment simulation
- Career support and coaching
- Internships or exposure tours to industry
- Access to networking and alumni e.g. through talks or WhatsApp groups
- Inclusion of socio-emotional skills (collaboration, creativity, problem solving etc.) and emotional skills (collaboration, creativity, problem solving etc.)

Other factors include the length of the course. Short courses maybe more affordable and effective in upskilling, but are less effective for securing formal employment. In certain

countries or cultures, gender-focused training courses can boosts results, especially for females. According to stakeholder interviews, females spoke up more often without a male presence and were more willing to challenge or share their own ideas. Some courses now include broader digital skills such as human-centred design and digital marketing to boost employability, for example the Soronko Coding Academy for Girls (Ghana). The Digital Academy and Harambee (South Africa) and Akirachix (Kenya) have specifically demand-led models, with employment rates of over 80%. Furthermore, some MNOs are seeking to fill the skills gap with their own classroom-based training courses.

Boot camps. Focused on delivering advanced developer skills, boot camps typically last three to six months (World Bank, 2017). They require pre-existing foundational skills to enhance gains from participation. In Africa, many boot camps are aimed squarely at closing the digital gap and addressing youth unemployment (ITU, 2016). However, the ability to deliver skills at scale is limited, with class sizes of around 30 people with an instructor to student ratio of 1:4. Higher ratios may compromise quality of learning outcomes. Although the costs are relatively low (USD500 to USD2,500), this still presents a barrier for the majority of young people in Africa for whom this is a significant cost (World Bank, 2017). Employability of graduates from six-month long boot camps ranges from 40% to 100% (ITU, 2016).

Innovation hubs. Innovation hubs also play a significant role in cultivating the tech ecosystem in Africa. GSMA (2019) highlights that there are 618 active tech hubs in Africa. These tech hubs include university-based and independent innovation hubs, incubators, accelerators and shared working spaces. Hubs lower the barrier to entry for youth by providing access to high-speed internet, advice and support, as well as access to skills training and competitions for funding. For example, I-CAN Centre run by the Western Cape government in South Africa provides free internet access for 45 minutes per day and digital training for youth. Similarly, MEST (Ghana), Bongohive (Zambia), Jokolabs (West Africa) and RLabs (South Africa) provide a space to learn digital skills and access technology for young entrepreneurs.

Mobile telecommunications operators have also played an active role in supporting innovation hubs in Africa, thus building e-leadership skills. For instance, Safaricom has supported tech entrepreneurs such as Little, a Kenyan e-hailing business. Safaricom has provided a zero-rated platform for Little cab drivers that they use to access to link with their clients. These tech hubs have also created a

platform for entrepreneurs to access venture capital. GSMA (2018) reports that African tech start-ups have managed to raise increase their funding by 53% between 2016 and 2017 to USD195 million. However, this is low compared to a 200% increase in venture capital invested in start-ups in the Asia Pacific region in the same period.

Bridging the gap. The effectiveness of dedicated skills providers varies by learning model and the type of skills being focused on. However, where successful these providers are delivering learning opportunities that are going some way to bridging the gap between supply and demand for digital skills. Although each cohort is necessarily small to ensure quality in-person support and a demand-led focus, the strongest examples provide a model that could be scaled. Several hubs have built brands that have expanded into multiple countries such as MEST and Impact Hub. Funding remains an issue for affordability in low-income settings and viability from a provider perspective. Many providers are partly government and/or donor funded. Where providers can build strong partnerships with companies who are willing to outsource training for a pipeline of employees, the cost can be absorbed by industry. For example, iLabs at Strathmore University in Kenya provides digital skills training for cohorts of new company hires on demand. Furthermore, financial incentives to providing digital skills are growing. The IFC estimates that 230 million jobs in SSA will require digital skills by 2030, which it estimates as a USD130 billion opportunity for skills providers to train the future workforce in digital skills.

Assessment of dedicated skills providers

Online training. Delivers at scale with low cost, but low on employability (without certification) and skills development, if not practical, cannot be assured. Socio-emotional skills are not developed through this mode.

Classroom-based learning. Strongest for building productive and developer skills, as well as employability. Also builds socio-emotional skills and e-leadership skills. Some consumer and foundation skills are also enhanced. However, classes are necessarily small so are low on scale with high costs.

Boot camps. Provide specific skills through intense learning and thus build consumer, productive and developer skills at relatively low cost. Although the depth of learning is not as significant, impacting on employability, scale can be achieved as courses are shorter and done in larger groups.

Innovation hubs. Provide learning opportunities in productive skills and e-leadership, as well as socio-emotional skills. Training is relatively low cost and there is a reasonable link to employment, either as an entrepreneur or within a company. However, developer skills are not the focus for innovation hubs.

4.4.4. Employers

Introduction. Given the current gap in the supply of digital skills, many employers recruit interns, providing exposure and experience for young people, while creating a potential pipeline for entry-level employment. Alternatively, employers absorb the cost of training staff in digital skills directly, through in-house training or ongoing on-the-job training and coaching. Stakeholder interviews revealed that it can take up to 18 months for new recruits to add value to the company, thus employer-based training is intended to accelerate this productivity.

The gap. Employers are increasingly recognising the need to upskill their employees while they are on the job. An enterprise survey by WEF (2017) revealed the 30% of employers in Kenya cite that lack of skills among employees is one of the major challenges hindering their business operations. WEF (2019) estimates that 54% of current employees will require reskilling by 2022. To resolve these challenges, companies often provide internships for potential employees and on-the-job training for their existing workforce.

Internships*.* The 4Afrika initiative by Microsoft provides real work experience for its students using its network of partners across Africa. Under this model, partner organisations hire Microsoft certified interns, trained in both productive and developer skills. The programme enrols around 250 students annually and has 530 alumni since inception in 2013. Although employability is high (90% of interns are successfully employed after the programme), the challenge has been to scale the opportunities, given the limited number of partner organisations and office space. Internships provide not only practical training and exposure, but also the development of socio-emotional skills such as collaboration, problem solving and resilience.

Building a pipeline. In Senegal, Sonatel-Orange the largest MNO, runs a coding academy, including one specifically for females. In doing so, it not only builds a cohort of young people with developer skills, but also provides for itself a pipeline of talent to recruit from, as many of the graduates

gain employment within the company. This could be seen as an internship training programme, but the focus is fully on training the individual first, to potentially add value later.

On-the-job training. Another employer-based approach for upskilling is on-the-job training. This usually involves the use of an external consultant trainer or in-house expertise. The use of external consultants or sending staff to a dedicated skills provider, is usually more appropriate for niche skills such as cyber security or AI, which may not exist in-house. On-the-job training is highly effective in upskilling a range of skills because of the practical learning experience it provides, as well as its direct relevance and immediate applicability to employees' work. However, it often comes at a high cost, limiting the ability of on-the-job training to reach scale. For instance, a training session on basic productive skills using Microsoft packages costs USD800 per person for three sessions through the PWC academy[28]. Our stakeholder interviews revealed that high-end developer skills, require around six months of structured training at a cost of USD10,000 per person.

Digital skills for the public sector. Given that the public sector is one of the largest employers in Africa, the adoption of e-government services presents an opportunity for professional government employees to build productive digital skills (Vrabie, 2012). Most European governments have pursued ECDL certification as a means to train public sector employees in basic productive digital skills (O'Donnell, S, 2003). In Romania, 12,000 staff enrolled for ECDL with 98% obtaining certification. This was part of an intervention aimed at enhancing the roll out of e-government services in Romania (Matei and Savulescu, 2014). To date, the basic minimum digital competency required by public sector professionals in Africa has not been defined. This poses a challenge for rolling out effective e-government services. There are also substantial gaps in the rolling out similar digital skills training for public sector employees (UNESCO, 2018).

Opportunities. Internships and on-the-job training provide some of the best opportunities for young people to build the most relevant digital skills to meet the specific demands of employers. However, young people need basic consumer

28 https://www.pwc.co.za/en/services/people-and-organisation/remchannel/training-and-workshops.html

and producer digital skills in order to be selected for such opportunities.

Assessment of employer-based training

- **Internships.** Strongest on providing socio-emotional skills, productive skills and employability. Some provide developer skills through guided self-learning. They are relatively low cost and may provide a return on investment for the company. They do not provide much scale or e-leadership skills.
- **On-the-job training.** Strongest on providing productive and developer skills. Staff are already employed, so employability was not measured. Costs can be high, limiting scale, but the return to the company overtime makes this an attractive investment.
- **Online certified training.** The ECDL, or the international version ICDL, provides a low-cost way to scale productive skills for entire companies or public sector departments. Work-based online training that is required and tested with certification increases the incentives for staff to learn and complete the course.

4.4.5. Product and service induction

Introduction. Product induction refers to user onboarding services for customers or providers the first time they use a digital product or platform. The largest scale induction of this kind on the continent are agents assisting customers to send or receive a money transfer. While money transfer services mostly use a USSD platform, the digital navigation skills acquired serve as an entry point to using more complex digital devices such as promoting goods and services on social media. Other forms of product induction include call centre assistance (human) or automated online step-by-step assistance, or voice recognition and chatbots services.

Needs-based skills development. Digital skills are practical in nature, and most basic consumer and productive skills are learned through necessity or curiosity. In the early days of M-Pesa, agents played the crucial role of coaching first-time users through a transaction service (Wilkinson, 2018). As such, the use of mobile money was directly related to the number of agents available in the community (Suri and Jack, 2016). However, consumers' skills of this nature, without subsequent training, are not usually sufficient for employment within the digital economy.

Other digital services in African markets are providing entry points for the delivery of digital skills, both consumer and productive. Twiga Foods in Kenya, which links smallholder farmers to markets and financing through a digital platform, employs field agents that migrate farmers' business processes from manual to digital creating profiles that can be used in accessing digital loans (GSMA, 2019). Twiga works with 13,000 farmers and 6,000 vendors in Kenya. This demonstrates the ability of service providers to deliver consumer and basic productive skills to customers and service providers at scale, by using digital products or platforms.

Opportunities. Product induction is quick and can be relatively low cost when delivered as part of the product offering. In terms of employability, product induction enhances employability in informal markets. The proliferation of e-commerce platforms and social media marketplaces presents a big opportunity for entrepreneurs to apply productive skills, linking with many potential clients, given that 40% of people in Africa are online (Internet Stats, 2019). However, there are few gains from a formal employment perspective because opportunities in the formal sector typically require digital skills training from accredited providers.

Assessment of product induction

Strong: scale and cost (if tech-assisted / remote)

Medium: cost (if agent based) and consumer skills

Weak: employability, socio-emotional skills, foundational skills, productive skills, developer skills, e-leadership skills

4.5. Insights from assessing different learning approaches

The following approaches emerge from the research as having the greatest potential for creating a tipping point in digital skills. Each one is highlighted with what it is a 'best for' and success factors are included. Some approaches are implementable for rapid results (usually at smaller scale) while other approaches are longer term, but are investments that will generate a broader pipeline of young people with skills for a digital world:

4.5.1. Digital skills, including coding, at primary schools

Best for scale, cost-effectiveness and equity. Introducing practical digital skills, including coding, at primary level has the greatest potential for long-term, country-wide impact. It can achieve scale, with equity, for early learning of consumer, productive and even developer skills. It will reach almost all children, regardless of gender, ethnicity and socio-economic background. It provides an opportunity for *all* children to gain confidence in using technology, to experiment with creating content and build navigation skills. Given the scale, the cost per child would be lower, thus also making this option cost-effective. This is a moon-shot option, but one that will change the game for upskilling and jobs in a digital economy.

Success factors. Quality digital learning content, teachers trained in using technology for learning, access to technology for practical use (can be smartphone-based if gamified), teaching approaches that focus on creativity and exploration, and the inclusion of non-tech lessons for kinaesthetic learning e.g. learning coding through physical games or building a process with cardboard or other available materials.

4.5.2. Productive skills as standard for secondary schools

Best for scale and long-term change*.* Given that a greater number of secondary schools already have access to electricity and some hardware and internet connectivity, secondary education interventions can leverage existing infrastructure for improving teaching of digital skills. Technology should be applied to non-ICT lessons to build a strong base for productive skills. Given the low numbers of students selecting Computer Science, this approach would reach the greatest number of students in secondary schools. Industry talks and opportunities for exposure tours or competitions for the best Computer Science students can encourage further enrolment in the subject. However, expanding from Computer Science into broader ICT, including multimedia, would reach a greater number of students. Secondary schools provide the opportunity for scale, but at a lower rate than primary schools.

Success factors. Quality up-to-date curriculum, trained teachers, access to technology for practical use, linkages to industry and tertiary institutions teaching tech subjects, and

learning approaches that focus on creativity, innovation and exploration.

4.5.3. Digital by default at tertiary level

Best for scale and long-term change. Although the numbers of young people enrolling at university are low, tertiary education has seen huge growth over the last decade and is likely to continue. Requiring all students to use computers for assignments and presentations (either personal or shared facilities) would drive self-learning and a purposing of digital technology across all subjects. Introducing students to internet research, online collaboration tools and platforms for sharing and uploading work, as well as exposure to digital data analysis, would contribute to building not only productive but also early e-leadership skills. Given that there are fewer institutions in a country, interventions can be more tailored to needs and cost-effective. Requiring all lecturers and faculty staff to pass the ICDL or similar would raise the basic standard and facilitate the digitisation of tertiary learning. Students could opt to do the same, as certification would boost employment potential.

Success factors. Access to high-speed internet and computer labs to access hardware on campus, links to industry to keep learning relevant, training of faculty staff and lecturers in digital skills.

4.5.4. Replicate and scale the best digital academies and universities

Best for employability and equity. High-quality university courses in Computer Science and coding academies are the best place for teaching developer skills. Blended learning approaches that combine classroom time with online learning build both theory and practical skills, while providing access to guidance and support. Several gender-based courses have emerged, which seek to close the gender gap and boost young females' confidence and competencies in digital skills. Merit-based scholarships or subsidised places can increase equitable access, though these would require external funding to be viable. By scaling the best teaching and building strong industry links for employment, the appropriate level of scale for higher-end developer skills can be achieved, especially in tertiary institutions. Those that include additional training in business, entrepreneurial mindset and design thinking can further strengthen employability for their alumni.

Success factors. Blended learning approaches, strong industry links for employment and to keep curriculum relevant, gender-specific classes where relevant, scholarships, teaching methods that build skills in creativity, problem solving and communication.

4.5.5. Open digital spaces

Best for equity and informal employment. Given the high number of youth not in education, employment or training, community learning centres, or open digital spaces (to borrow from the Senegalese concept) can extend the reach of digital skills with equity. Leveraging existing infrastructure where possible, redesigned to be attractive and welcoming places for all young people, such spaces enable young people to access the internet, technology and take advantage of self-learning (via MOOCs) or taught opportunities on site. Open digital spaces, if combined with trained staff or digital brokers, have the potential to address the gaps in digital skills in a meaningful way. The focus here is on building consumer and productive skills to enhance opportunities in the informal market.

Success factors. High-speed internet, trained staff, technology and 'youth friendly' designed spaces, which can double as co-working spaces for youth entrepreneurs in the informal sector.

4.5.6. Industry-linked e-leadership training opportunities

Best for employability. E-leadership skills are best taught through industry-linked training and exposure tours to digital centres of excellence or leading digital businesses. Access to existing e-leaders through networking events or mentoring can strengthen young rising stars (from public or private sectors or in tertiary education) to become e-leaders. Ideally, this should be combined with self-learning opportunities for significant skills to emerge; including classroom-based learning focused on real-world solutions, at high-quality tertiary institutions or innovation hubs, and digital economy focused MOOCs. This will provide the practice-theory-exposure combination needed for e-leaders to emerge. This can be achieved through programmes that emerging talent, for example the top 30 e-leaders under 30, for dedicated acceleration programmes linked to industry and cutting-edge approaches. Exposure tours of one to three months in a country with a well-established digital economy would expose young leaders to high-quality systems and

business processes, which may be unavailable in their home countries.

Success factors. Existence of digital learning centres of excellence (public or private), bursaries or industry support for exposure tours, strong industry links and networks of existing e-leaders (with a diversity focus)

4.5.7. Leverage online certification for all public sector workers

Best for cost-effectiveness and scale. The rise of e-government services is impacting the demand for productive digital skills across the public sector. This includes staff in education and health sectors, building and transport licensing, legal and trade sectors. Given the number of people employed by governments in Africa, raising the standard of digital skills with public sector workers will achieve huge scale and enable e-government systems to function, with positive knock-on effects for all citizens, including young people. Existing standards such as the ICDL can be leveraged. As staff move from the public to the private sector, certification must be transferable.

Success factors. Ensuring strong political support and buy-in, management follow-up and accountability for results, relevant content for certification tests and assure quality standards in the testing process to build trust and achieve results

4.5.8. Self-learning through use of digital products

Best for cost-effectiveness and scale. Given that consumers' skills can mostly be self-learned, the utilisation of digital platforms or products is also an ideal mode to learn-by-doing, including e-government services. Building on consumer skills, the use of digital platforms and apps by merchants to boost business opportunities can also build productive skills by default.

Success factors. Low-cost smartphones, user-friendly e-government and business service apps or mobile friendly websites that meet both customer and supplier needs, and that can be used even by those with only basic consumer skills or busy informal sector workers

Box 2: Building equity into digital learning opportunities

For an equitable society, where all young people have the opportunity to build the skills they need to engage in the digital world, a number of important action steps can be taken.

1. Start at primary: Even those from the most marginalised backgrounds and female students can be given the opportunity use technology in primary school. Rural schools must be included to address the digital divide with urban schools.
2. Create for mobile: most young people in Africa will access the internet via mobile, so creating learning materials specifically for smartphones will reach those without access to tablets or laptop computers.
3. Equity modelled by content: learning content, digital or printed, should include characters of different genders and ethnicities, as appropriate. The equity dimension is critical for digital skills and equitable employment. The use of female teachers and role models from different ethnic backgrounds is important for consumer and productive skills.
4. Courses for females: gender-specific classes provides a safe environment to learn and test ideas, especially for learning developer skills. A connection with a female mentor in the industry and to also become ambassadors themselves to other young women will further spread the idea that women can code and can be e-leaders.
5. Engage males in industry: it is also important for current (male) executives and board members in industry to engage meaningfully on equity and learn the importance of in bringing in diversity into their teams, to build better products and businesses for the future.

5. Country diagnostics

The country diagnostic component of the report builds on the insights from previous sections. The objective of this section is to provide an understanding of which digital skills young people need to access economic opportunities in the respective countries in the future. This requires an assessment of how economies are developing, how the effectively skills providers are equipping young people for the digital economy, and what the challenges are. Each country diagnostic thus includes key contextual information, the market for digital skills and concludes with a short section on potential interventions that will promote the development of digital skills in the respective country.

5.1. Ghana

5.1.1. Country in context

Ghana is currently one of the fastest growing economies in the world and the fastest growing mobile money market in Africa (World Bank, 2019). Although much of the economic growth is being driven by oil, other sectors such as agriculture, manufacturing and services are also growing. E-government is being rolled out to bring greater transparency and trust to service provision, and to modernise its administration. Fibre optic internet is being installed. Universal primary education, including for girls, is within reach and 92% of youth are literate (UNESCO, 2019). Despite the many challenges it faces, Ghana is a country with significant potential. In this first section we provide a brief overview of the country before unpacking the supply and demand for digital skills, and key insights.

Ghana's potential demographic dividend. With almost 30 million people, Ghana has the second largest population in West Africa, after Nigeria. As with many countries in Africa, the age structure is young and growing. A third of its population is aged 15–35, with a median age of 21. The youth population is projected to double by 2030 to 20.2 million (UNESCO, 2019). However, the ILO estimates that 30.5% of youth between the ages 15 and 24 are not in education, employment or training (2017).

Secondary school enrolment rate well below primary, but tertiary education increasing. With an enrolment rate of 83.5%, the primary education system is quite extensive,

with slightly higher enrolment rates for girls. However, only around 60% of students are enrolled in secondary school, leaving a sizeable portion of the population without the required 11 years of compulsory education. Furthermore, according to the most recent Ghana Demographic Health Survey (2014), as few as 35% of girls complete upper secondary. Although enrolment in tertiary education is low, it has increased significantly in the past few decades from 1% in 1995 to 6% in 2005 and 16% in 2017.

Significant investment in internet infrastructure. The installation of fibre optics is significantly increasing the coverage of high-speed internet in the country. The government is investing USD80 million to extend the national fibre backbone infrastructure to districts in the eastern and western parts of the country to provide access to fast, reliable and affordable broadband network services to local communities, government and businesses (Government of Ghana, 2015).

Mobile devices are the gateway to the internet. The SIM card penetration in Ghana is 131%[29], with 62% of the population covered by a mobile broadband network. Smartphone penetration, at 38%, is steadily rising as devices becomes more affordable. The prevalence of personal computers is also increasing. In 2010, 7.9% of household had access to a personal computer, but by 2018 this has grown to 23%. However, mobile phones remain the main channel through which Ghanaians access the internet, with 33% of the population actively accessing the internet in this way.

Cost of mobile data relatively expensive. At USD4.1, the price for 1 GB of mobile data is below the West Africa average of USD6.2 (A4AI, 2018). However, according to The Alliance for Affordable Internet, it is relatively more expensive. 1 GB is equivalent to 3.3% of an average monthly income, well above neighbouring Nigeria (1.6% of income) and South Africa (2.5% of income), but below the overall African average of 7% (A4AI, 2018).

29 Many consumers own more than one SIM card.

	2018
Population access to electricity (2017)	79%
Mobile internet subscribers (population)	33%
Smartphone penetration (population)	38%
Households with a personal computer	23%
Mobile broadband cost of data (1 GB as % of GNI per capita)	3.3%

Table 2: Ghanaian infrastructure and digital devices statistics, 2018

Source: World Bank World Development Indicators, 2019; GSMA, 2018; A4AI, 2018; ITU, 2018.

Growing economy, with majority employed in the informal sector. The Ghanaian economy is growing rapidly and is expected to grow at 8.8% in 2019, based on strong performance in its commodities market[30] (IMF, 2019). However, the labour force participation rate has decreased since 2000 from 75.5% to 69% (ILO, 2018). Youth are particularly at risk of unemployment, with 26% of young people unemployed in 2015, compared to the national average of 12% (ILO, 2018). It is estimated that 80–90% of the population are employed in the informal sector, which contributed an estimated 28.6% to GDP in 2018 and grew at an annual rate of 3.4% between 2014 and 2018. It is thus of significant importance to the economy, with 62% of commercial establishments counted as informal (Ghana Statistical Service, 2016).

Services sector is the largest contributor to GDP.
The agricultural sector has lost its dominance in national output, dropping from 30.4% of GDP in 2006 to 19.4% of GDP in 2017. In contrast, the services sector has seen significant growth, rising from 37.9% of GDP in 1990 to 59.5% of GDP in 2018. The industrial sector's contribution to GDP remained stable at around 21%. However, manufacturing declined from an already low 9.5% in 1995 to an even lower 5% in 2018. Figure 10 indicates the real GDP growth per sector from 2006 to 2016. The expansion of the services sector in Ghana is also noticeable in its contribution to exports and employment. Service exports as a percentage of GDP increased from 4.5% in 2010 to 11.2% in 2017. The services sector is the largest employer in the economy,

30 Ghana is the second-biggest producer of gold on the African continent, and the world's second-largest cocoa producer. The country is also home to one of the largest discoveries of oil in recent decades.

accounting for 47% of total employment in 2018, up from 31% in 2000.

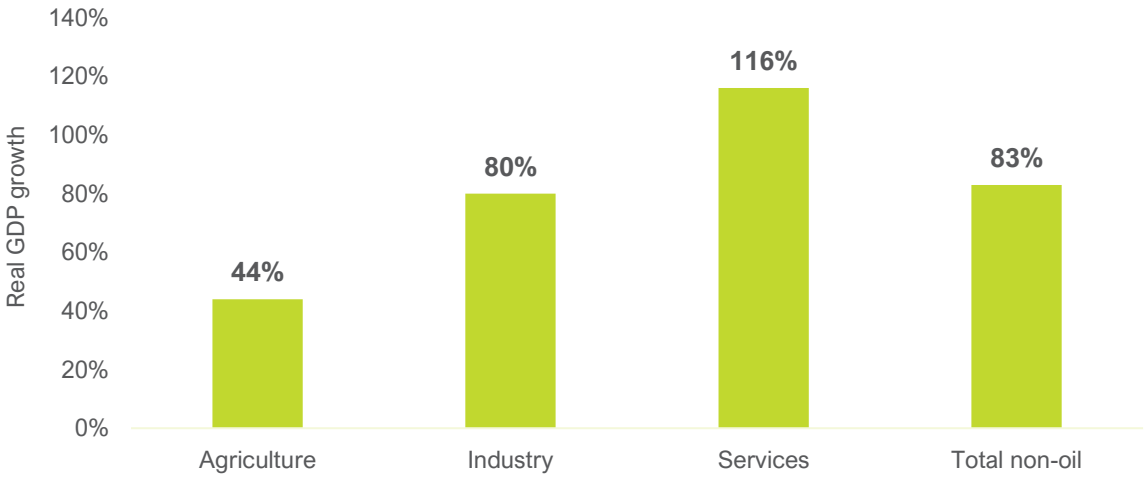

Figure 10: Non-oil, real GDP growth per sector, 2006–2016

Source: Ghana Statistical Service, 2017

Understanding the services sector. It is useful to unpack the service sector into sub-sectors for a more nuanced understanding of its growth. The largest contribution is made by the trade and repair of goods sub-sector, accounting for 15% of GDP, followed by transport and storage at 7%. Other sizeable sub-sectors include financial services and hospitality, which both contribute 4% (Ghana Statistical Service, 2017). However, it is important to note that the contribution of the informal sector is not included in official GDP statistics.

The ICT sector growth in the services sector. Although still small, contributing 2.4% of GDP in 2018, ICT has been rising rapidly within the service sector. It grew at an annual average of 12.9% between 2014 and 2018. This has been enabled by increasing internet connectivity, extensive infrastructure investments and rising mobile data usage. The last official employment figures, published in 2014, showed that the ICT sector employed approximately 40,000 people, with about 5,000 people employed as computer programmers and related activities. Considering the doubling in economic output by the sector, it is like that this number has increased substantially since then (National Communications Authority, 2018).

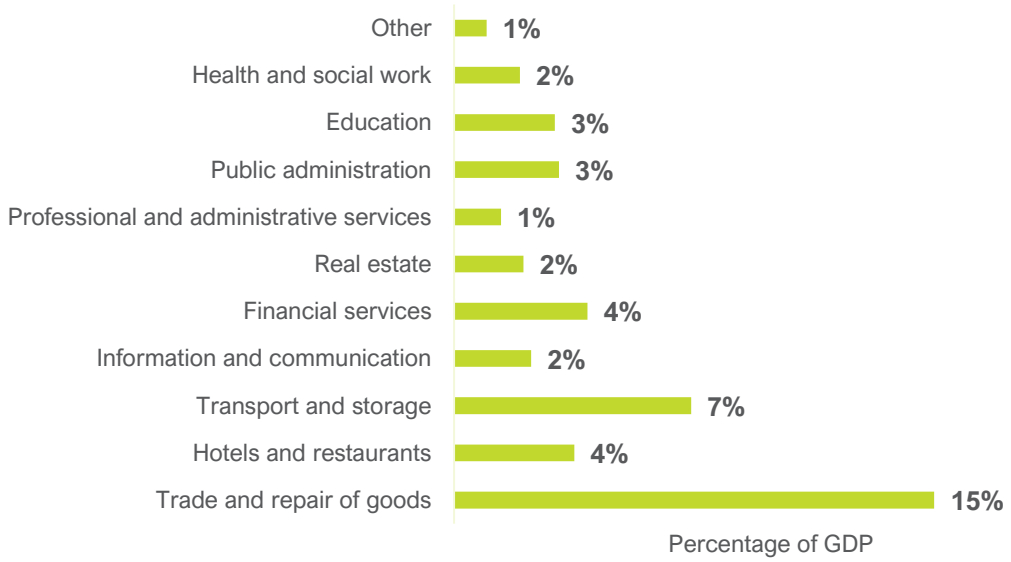

Figure 11: Breakdown of sub-sectors in services sector by contribution to GDP

Source: Ghana Statistical Service, 2018

5.1.2. The market for digital skills

Policy

Building a robust digital sector is a policy priority for government. The Ghanaian government has a "serious digitisation agenda" (Stakeholder interviews, 2019), which aims to provide an enabling environment for digital citizenship and employment to flourish. In 2014, it enacted an ICT for Accelerated Development (ICT4AD) policy. It aims to transform the country into a middle income, information-rich, knowledge-based and technology driven economy and society.

E-government is being implemented. Ghana has been rolling out a system of e-government as a reform tool with some successes, in order to digitise its administrative services and to increase transparency and efficiency for its citizens. It includes an interoperability network between different ministries and makes significant strides towards digitisation in the judicial system, the ports, automation of the application for business and construction permits.

Standardising ICT in the curriculum. ICT was officially introduced as a core subject into the curriculum in 2007. According to the policy, all students from junior secondary and upwards attend ICT lessons at least weekly. The ICT4AD policy for education includes the provision of hardware and internet access for all educational institutions, as well as ICT

training for staff (including at the Ministry of Education) and the promotion of e-learning to complement campus-based education. In reality, implementation has not been fully achieved. However, during the 2015-16 academic year, 31,000 primary school teachers were trained in ICT (Ghana Education Service, 2019).

Implementation of ICT4AD is challenging. Despite the political will, insufficient human and financial resources have hampered implementation. For example, the Ghana Investment Fund for Electronic Communications (GIFEC) was established with telecommunications funding to expand access to internet and computer technology to rural and underserved communities. Despite some interesting pilots, including a partnership with an MNO and a donor-funded 'Smart Communities' initiative, insufficient resources have limited its expansion. A big constraint in the public-private partnership was that the communities selected by GIFEC were too underdeveloped to be of sustainable for the MNOs participation (Stakeholder interviews, 2019). The challenges for ICT4AD in schools are elaborated below.

Supply of digital skills

School-based learning of digital skills constrained by infrastructure and hardware. The public education system faces many challenges in its ability to produce cohorts of graduates with even consumer digital skills. Few public schools have access to computers and internet connectivity, and access to electricity is limited, particularly at primary school level. In 2018, fewer than 10% of primary schools had access to internet for pedagogical purposes, while only 3.5% had access to computers. While these figures are higher at secondary school level, they remain low, at 20% and 14% respectively. Access to electricity is a severe constraint. In 2018, only a quarter of primary schools and just under half of all lower secondary schools had access to electricity, while 79% of upper secondary schools had access (UNESCO, 2018). As a result, the majority of students are taught the IT curriculum without the use of a computer. A study conducted in the Ashanti region[31] found that 96% of students did not have access to a computer lab for practical learning (Peprah, 2016). Teachers are left with few options but to use chalkboards for teaching ICT or to read directly from textbooks instead.

31 Ashanti is the third largest region in Ghana and approximately 20% of Ghanaians live there. The regional capital is Kumasi.

Teachers require upskilling to effectively teach digital skills. In addition to infrastructure challenges, there is also a teaching gap. The same study in the Ashanti region found that only 1.9% of students had a specialised IT teacher (Peprah, 2016). According to the World Bank (2017), Ghana faces a shortage of over 140,000 trained IT teachers across its public and private schools[32]. The challenges to teaching skills to prepare youth for work in a digital world extends beyond training in IT. Skills such as critical thinking, problem solving, innovation and collaboration are often quoted as essential for the future of work; yet much of Ghana's education system remains focused on rote learning, memorisation and a one-way didactic flow from teacher to child, which does not enable these skills to develop. It is worth noting that the curriculum is being updated and will include a stronger focus on these transferrable or socio-emotional skills (Stakeholder interviews, 2019).

Quality and quantity of digital skills training limited in tertiary education. Ghana has a low number of STEM graduates. In 2017, of the 104,851 tertiary education graduates, only 13% graduated from STEM programmes, with ICT-specific programmes accounting for a mere 0.12%[33]. This is a major constraint for the supply of digitally skilled labour, especially for productive and developer digital skills. Similarly, a World Bank report found than Ghana has fewer than 1,000 graduates with IT-related degrees each year (2017). A lack of institutional support, outdated curricula and insufficient resources limit the ability of students to gain productive digital skills across degree types and many graduate without a proficiency in basic MS Office. This means that companies absorb the cost of training new graduates internally. However, some innovative lecturers find ways to build the digital skills of their students, for example, by introducing students to cloud computing software for collaborative project work or teaching students to analyse social media data for digital marketing projects (Stakeholder interviews, 2019).

Dedicated digital academies making small inroads in large skills gap in the market. Ghana has a number of private learning institutions where young people can gain specific skills in programming languages or digital

32 In total there are approximately 161,500 trained primary school teachers and 167,150 trained secondary school teachers in Ghana (World Bank, 2018).

33 For comparative purposes, in 2016 in Kenya there were 217,329 tertiary education graduates; of these 16.5% graduated from STEM programmes, with 5.3% ICT-specific. In South Africa in 2017, there were 232,604 tertiary education graduates; of these 18.6% graduated from STEM programmes, with 5.3% ICT-specific.

technologies. These are currently concentrated in Accra. A number of institutions have gained good reputations, attracting private sector recruiters to place their graduates. Successful coding academies have learned to integrate design thinking, socio-economic skills and mentoring, alongside technical skills, to enable their students to adapt to the work environment, especially for females, for example the Soronko Academy and Developers in Vogue. However, these academies are small, training around 200 students per year, which is not enough to supply the market. Finding appropriately skilled teachers is also a major constraint – without which they cannot teach cutting-edge developer skills or scale their existing programmes. One such training centre struggled for two years to find its current complement of ten teachers (Stakeholder interviews, 2019). Consequently, many Ghanaian firms have to recruit internationally for developer skills.

Box 3: Ashesi University bringing cutting edge education to Ghana

Ashesi University is one tertiary educational institution that is bucking the trend in Ghana. A private charter university, it aims to provide a new model for Africa and has been awarded for its innovative approaches. Its modern campus has high speed internet and its teaching programmes are designed in collaboration with some of the world's best universities. It offers a variety of STEM degrees, including BSc. Computer Science and BSc. Management Information Systems. All students must acquire a laptop, as work is assigned digitally and must be submitted digitally; as such, all students learn digital skills by default. Students are given real-world problems to work on in teams, building critical thinking and problem-solving skills, and potential solutions are presented using PowerPoint. Emphasis is given to innovative and elegantly designed solutions. In addition, the university partners with the private sector to organise industry visits and give students hands-on experience. The results are compelling: an almost 100% employment, entrepreneurial or graduate school acceptance record for its graduates (within six months). Over 100 students enrol at Ashesi each year. During other stakeholder interviews, managers expressed a strong preference for hiring graduates from Ashesi (Stakeholder interviews, 2019).

Incentives for continuous learning at corporates not enough to motivate staff. Interviews with private sector managers indicated that most employees do not see the need for continuous learning. Despite the availability of a vast array of training course via in-house portals or opportunities paid for by the firm, the incentives are not aligned to motivate staff to take advantage of these. Even if they do, there is little accountability for self-improvement and results in implementing learning on the job. There are exceptions, though; some ICT and tech product managers

highlighted that high-end developers on their teams were originally self-taught (Stakeholder interviews, 2019). However, the culture of continuous learning is absent in most companies.

A lack of awareness about career opportunities for young people with developer skills. A further challenge to the supply of digital skills is, to an extent, posed by its newness. Parents and older generations do not see the purpose or opportunity of a career in ICT. One operations manager for a coding school for females told us that despite her successful position, her parents still ask her when she will get a 'proper job'. A perception that jobs in ICT are for fixing computers and appliances is still prevalent (Stakeholder interviews, 2019).

Young women face additional barriers to learning developer skills. Young females face additional challenges in acquiring the digital skills. There are steep opportunity costs for young females to invest in learning opportunities. Caring for a family and household chores prevent many from being able to access training, while others working in the informal sector do not have the ability to take time off to invest in building productive or developer skills. Stakeholder consultations also revealed that many females do not have the confidence to enter the male-dominated ICT space, although the presence of a supportive father or husband was seen as a way to overcome this. A lack of female role models for young women to follow prevents some from considering such jobs. Coding academies for females play a significant role in addressing this. However, these academies do not have campuses or the resources to accommodate their female students and help them overcome the challenges of home-life responsibilities or to provide opportunities for females outside of Accra (Stakeholder interviews, 2019).

Demand for digital skills

Growing tech-savvy population points to rising consumer digital skills base. Consumer skills are difficult to measure across the population, but by using key proxy indicators we can build a picture of the prevalence in Ghana. Firstly, the number of active social media users in the country has grown from 4.6 million in 2017 to 5.8 million in 2019, with the vast majority using mobile devices to do so (Hootsuite, 2018). Secondly, according to Global Findex (2017), 49% of Ghanaian over the age of 15 had made a digital payment in 2017, compared to 25% in 2014, while those who used the internet to pay bills or buy online in the past year rose from 3% in 2014 to 8% in 2017. The growing

levels of consumer skills in Ghana are also evidenced by the rising demand for online services, including e-government, mobile money and banking, online health and information services, as well as shopping and other consumer services (Deloitte, 2017).

Demand for digital skills in the informal sector is growing. Those working in the informal services sector can also boost their business opportunities by using digital technology. From our stakeholder interviews, this included marketing services and products via social media platforms, such as Instagram and Facebook, the use of WhatsApp to communicate with customers, and mobile money for secure payments. Demand for productive, as well as consumer, digital skills is growing in this sector, and those who are tech-savvy are likely to capture greater business opportunities. This indicates the potential impact that increasing digital skills in the informal sector could have (Stakeholder interviews, 2019). The IFC estimates that, in 2018, 25% (2.6 million) informal sector jobs required some level of digital skills and expects this to increase to 45% (5.4 million) in 2030 (IFC, 2019).

Box 4: Too tired to shop at the market?

In Kumasi, a major city, many young people migrate for work and often end up as porters or 'Kayas' to carry customers' purchases for them at the market. KayaApp, developed by EMB Ahenfie with the support of HapaSpace Innovation Hub, connects customers to a Kayayes (head porters) to request grocery shopping with delivery, supported by online payments. The Kayas are often young women, many of whom are illiterate, but can shop at the market for you and deliver groceries to your home or office.

New hires lack much needed productive skills. The growth in the economy, across all sectors, is creating more employment opportunities for Ghanaians. However, young people applying for entry-level positions are not sufficiently digitally literate. Stakeholder interviews with private sector HR managers and senior managers indicate that the biggest skill gap lies in the content creation competency – primarily the use of MS Office. This includes not being able to draft a professional document, prepare a PowerPoint presentation, conduct simple analysis in MS Excel or even conceptualise a technology-based process in draft on paper. As the digital economy in Ghana grows, so will the demand for productive skills across all industries. Even sales jobs, which were traditionally based on face-to-face interactions, now require digital skills as staff are

required to use databases and review customer accounts and balances. Managers were particularly frustrated by the lack of quality of the digital skills young people receive from tertiary institutions:

"We need Business Intelligence, but the universities are not producing data scientists, we have to train them internally."

– Head of HR, corporate

"There is a huge gap and students from tertiary institutions struggle to settle in because they lack these essential skills. Organisation take it upon them self to accelerate and bring such talents to speed on these skills."

– Head of HR, MNO

The IFC estimates that 60% of all new hires in the formal economy in Ghana will require digital skills in order to be productive. That is approximately 1.3 million people. It predicts that this figure will rise to 80% (3.7 million) by 2030 (IFC, 2019).

The growth in the ICT sector is driving demand of developer skills, but they are scarce. The 12% annual growth rate in the ICT sector is indicative of economic opportunities for young people with developer skills. However, developer skills are even more challenging to find than productive skills. Although employers would prefer to hire locally, they cannot find a sufficient of number skilled developers to build new and innovative customer-focused products. Nearly 20% of Ghanaian companies surveyed in an IFC study (2019) recruit only internationally for digital skills. The developer skills of existing staff are also an issue for ICT companies, as they struggle to find employees that can think innovatively and creatively: "We need people who can think how to leverage technology to solve problems" (Stakeholder interviews, 2019).

Low salaries for entry-level developer skills positions are unattractive. The financial incentives to attain developer skills are misaligned. Stakeholder interviews revealed that the average salary for an entry-level developer working in a non-IT firm is about GHS1,600 (USD294) per month and around GHS1,000–GHS1,300 (USD184–USD239) per month for those working in IT companies. This is equivalent to half the salary of a public-school teacher in Ghana (Stakeholder interviews, 2019). However, this may be a reflection of the current quality challenges and the cost of in-house training that companies currently absorb with each new hire.

Tech ecosystem is growing a market for e-leadership skills but funding a challenge. Ghana's tech ecosystem is flourishing, with 24 active tech hubs identified in 2017, up from 16 in 2016. Hubs such as MEST, Impact Hub, Kumasi Hive, Hapaspace and iSpace Foundation are driving innovation and entrepreneurship in the country. To drive quality standards between innovation hubs, a Ghana Hubs Network was established in 2017 and currently has 12 accredited members, mostly in Accra and Kumasi. Some hubs provide training programmes (digital and entrepreneurship)[34] and incubation programmes for start-ups, while others are more akin to a co-working space with high-quality internet and support available, as well as access to information and competitions for seed funding. These hubs are enabling the growth of productive and developer digital skills talent, and some e-leadership skills, which makes Ghana a more attractive destination for tech firms. For example, in 2019, tech giant Google chose Ghana as the location to open its first African Artificial Intelligence lab. A new generation of tech entrepreneurs is emerging, who are building promising start-ups like Agrocenta, Asoriba, ExpressPay, Farmerline, Kudobuzz and OMG Digital. However, funding and collaboration among these hubs remain a challenge to building scale, and while incubation is offered, acceleration is limited and accessing investment, particularly patient capital, is difficult.

5.1.3. Conclusion

The government is serious about digitising, but implementation is challenging. The government has made firm commitments to digitise Ghana through its ICT4AD policy. The full roll out of the e-government initiatives will entrench the digital sector even more in the lives of Ghanaians. However, there are implementation challenges stemming from constrained financial and human resources.

Public education in Ghana faces severe challenges to teach digital skills. The primary school network reaches almost all Ghanaians, but most lack electrification, access to internet and access to computers. Secondary schools typically have better levels of infrastructure and hardware,

34 For instance, MEST offers a 12-month, full time, fully sponsored programme in which students complete a graduate-level course in software development, business and communications. Hapaspace has a code4girls programme that equips participants with the basic knowledge of HTML and CSS. iSpace has the Unlocking Women and Technology (UWAT) programme that aims at empowering women to dominate the tech industry by equipping them with tech and creative skills, giving them the opportunity to learn how to code and start up their own businesses.

but enrolment rates are lower. Furthermore, schools struggle to find specialised teachers that can teach IT-related subjects.

Calibre of digital skills delivered by secondary schools and tertiary institutions insufficient. The digital skills training that students at secondary schools and tertiary institutions receive is often conceptual and not practical. This is problematic, since digital skills are practical in nature. Consequently, most graduates do not have basic productive digital skills and employers must invest substantial resource to train new hires.

Demand exceeds supply of digital skills, currently and expected in future. Discussions with HR managers and digital skills providers indicated that there is a big gap in the market for productive and, especially, high-quality developer digital skills. This is also confirmed by the growth in sectors such as ICT that requires typically more advanced digital skills. However, entry-level salaries are low. In a market where skills are scarce, the price should be high, not low. This discounted price indicates that employers take into account the resources they need to spend to upskill new recruits before they start to add value.

Consumer digital skills are keeping up with access to technologies. Ghanaians have embraced the digital sector. Ghana has the fastest growing mobile money market in the Africa and the number of e-commerce platforms has increased steadily. The uptake of these services indicate that Ghanaians have the necessary consumer digital skills to engage in the digital economy.

Mobile devices main gateway to the internet. Mobile broadband coverage is good and steadily increasing. Similarly, smartphone penetration is rising quickly and is already the preferred device for accessing the internet. The price of data is still more expensive than in some other West African countries such as Nigeria, but it is trending downwards.

The scale of the informal sector presents the biggest opportunity for digital skills. The vast majority of economically active people work in the informal sector. The digital economy is already impacting this sector and so is the demand for digital skills, albeit more slowly that in the formal sector. However, the scale of the informal sector provides the biggest opportunity for impact in digital skills for boosting employment.

A services-based formal economy, with a rapidly growing ICT sector. The services sector in Ghana is steadily increasing its relative contribution to GDP. This is noteworthy in a country whose exports are mainly dominated by commodities. Even though the ICT sector is still relatively small compared to the retail trade and transport sectors, it has doubled in size in past five years.

5.1.4. Opportunities for digital skills development in Ghana

The growth in the Ghanaian economy, coupled with strong government commitment, creates a context that can offer young people with digital skills significant opportunities to acquire meaningful work. Below are the four most pertinent opportunities based on the diagnostic.

Leverage smartphone revolution for pedagogical purposes. A lot of online education content to teach digital skills is designed for computers, not smartphones. Given that Ghanaians mostly access the internet via mobile phones, children are more likely to access the internet in the same way. Developing mobile-specific, gamified educational content, appropriate for the Ghanaian context, could open up learning access. The Ed-Tech sector in Ghana is not as mature as in Kenya or internationally, but Eneza[35] is one example of this content. Even though most productive and developer skills are more suited for learning on laptops, basic digital skills can be taught via smartphones. It is these basic skills that can build the foundation for a competitive advantage in the informal sector. This opportunity will become more scalable as the cost of data decreases and smartphone penetration increases.

Facilitate the involvement of private sector in teaching digital skills in public education. The demand for digital skills is significant and growing. However, employers cannot find the skills they need, because the education system is not teaching them. Establishing partnerships between private sector digital skills practitioners and public education will alleviate the shortage of teachers. It will ensure that students acquire skills with practical applications. This opportunity will require the facilitation of public-private partnerships to ensure that all the relevant stakeholders are committed. Where possible, women should be used to raise the profile of women in tech (as teachers or professionals).

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35 https://enezaeducation.com/ghana/

E-leadership study tours. Ghana has an ICT sector that is growing quickly. But, as pointed out in section 3, there is a real risk that the trend of globalisation in the digital economy may nullify opportunities in the services sector of uncompetitive economies. To enhance competitiveness, Ghanaians should be exposed to digital economy business models that are driving the development of the digital sector. One or two digital skills centres of excellence should be selected and linked to international teaching exposure to present male and female students with a more in-depth and higher quality learning experience.

Establish ICT community centres. Build or repurpose existing structures to create youth-friendly ICT community centres where young people can access training and opportunities presented by the digital economy. Setting up open access community centres, with the necessary infrastructure, will elevate the stature of learning digital skills as more people become aware of the opportunities that it offers. These community centres should also host classroom-based digital skills training opportunities facilitated by a qualified ICT professional. To strengthen the visibility of women in the digital space, centres could include female staff or host talks / meet ups with women in tech.

5.2. Kenya

5.2.1. Country in context

Of the three diagnostic countries considered in this report, Kenya has the most advanced digital economy and vibrant tech ecosystem. It has a higher demand for and supply of digital skills. The findings bring into focus some key gaps but also opportunities for experimentation.

Large population, with a considerable proportion of youth. Kenya has a population of 51.3 million people, with more than 75% under the age of 35 and a median age of 19. Although the population growth rate is trending downwards, it is still significant, and Kenya is projected to have a population of 66 million by 2030 (World Development Indicators, 2019).

Access to schooling almost universal at primary level but not at secondary level. Official education statistics for Kenya are somewhat outdated. The latest primary education net enrolment figures from 2012 indicate 81% of appropriate-aged children are enrolled. The latest data for secondary education, from 2009, show a net enrolment rate

of 48%. Ten years on, this is likely to be higher considering the development that the country experienced in the past decade. In 2016, the lower secondary completion rate was 79%, and the upper secondary education completion rate was 42% (World Bank, 2018).

Tertiary education dominated by universities. Enrolment rate for tertiary education has increased from 9.4% in 2015 to 11.6% in 2016. Most students go to universities rather than TVET institutions. In 2017, almost 500,000 students enrolled at universities compared to 275,000 at TVET institutions. Since 2017, there has been a decrease in enrolment, as the government clamped down on sub-standard institutions to ensure the academic integrity of tertiary education in Kenya, closing down more than 50 campuses. The enrolment in TVET institutions remains below the policy target of one million by 2019, despite government intervention (Mugo, 2018).

Significant investment in physical ICT infrastructure. Investment in ICT infrastructure has enhanced Kenya's connectivity through undersea cables and national fibre optic systems. In 2009, Kenya connected to the international broadband highway through the SEACOM, TEAMS, EASSY, and LION undersea fibre cables. The second phase in the roll out of ICT infrastructure, was the distribution of internet infrastructure through the Kenya National Fibre Optic Backbone Initiative (NFOBI). All 47 counties are connected to terrestrial fibre optics through the Government Common Core Network (GCCN).

Significant access to the internet through mobile devices. The penetration of mobile subscriptions is high in Kenya. Approximately 91% of Kenyans (47 million) have an active mobile subscription, compared to 80% in the rest of Africa. Mobile internet penetration is also high at 84%, compared to 36% in Africa (World Bank, 2018). According to the Pew Research Centre (2018), smartphone penetration is 30%[36]. This seems lower than expected in an environment with such high mobile broadband penetration. A recent Deloitte Global Mobile Consumer Survey (2019) puts access to smartphones at 97%, albeit as "own or ready access to one at home or work". Whether through ownership or by access to someone else's, it is clear that the mobile phone

36 The smartphone penetration data is contentious and differs greatly by source. We have used data from the Pew Research Centre, 2018 for this report. For more information see: https://www.pewresearch.org/global/2018/10/09/internet-connectivity-seen-as-having-positive-impact-on-life-in-sub-saharan-africa/

(smartphone or non-smartphone) is by far the most common device through which Kenyans access the internet.

	2018
Population access to electricity (2017)	64%
Mobile internet subscribers (population)	84%
Smartphone penetration (population)	30%
Households with a personal computer	7.2%
Mobile broadband cost of data (1 GB as % of GNI per capita)	3.1%

Table 3: Kenya infrastructure and digital devices statistics, 2018

Source: World Bank World Development Indicators, 2019; GSMA, 2018; A4AI, 2018; ITU, 2018.

Cost of mobile data relatively expensive, but cheaper than in other African countries. Investments in infrastructure have substantially lowered the cost of data. In 2019, the cost of 1 GB of data is USD4.19, which is 3.1% of monthly GNI per capita (ITU, 2018). By contrast in 2015, 1 GB of data cost the equivalent of 9.72%. The average of cost of 1 GB of data in Africa is USD6.2.

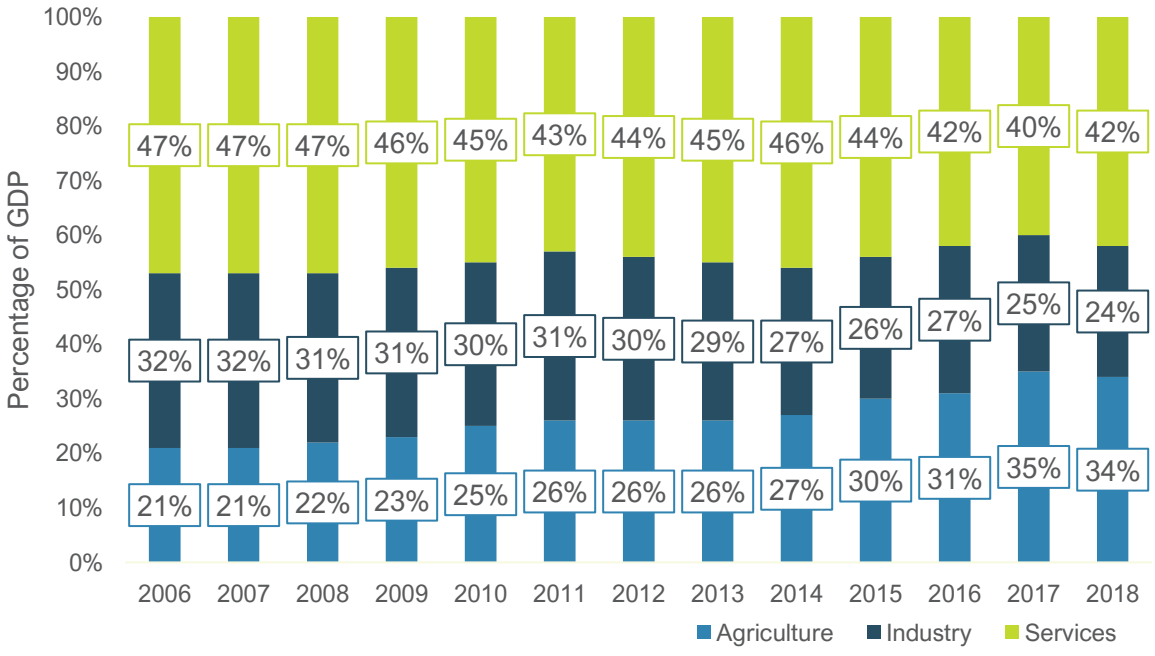

Figure 12: Relative contribution to GDP per economic sector

Source: World Bank, 2018

Economic growth driven by productivity increases in the agricultural sector. Kenya's economy has grown consistently over the last two decades, with an average five-year growth rate of 5.6%. However, the relative contribution of the different economic sectors has changed over time. Figure 12 illustrates this change. The services sector is the largest contributor to GDP at 42%, followed by agriculture at 34% and then industry at 24%. In the last decade, the relative contribution of the services sector decreased by 5% and industry by 8%, while the contribution of agriculture has increased by 13%.

Application of technologies driving agricultural productivity. Trends in agriculture point to increased digitisation of value chains across major agricultural commodities. The improved efficiency leads to increased levels of productivity and, consequently, economic output. For instance, the flower industry applied blockchain technology to improve supply chain management, linking flower farmers to global markets. This involves creating an electronic shipping platform by digitising all documents using blockchain technology to increase transparency and security among all trading partners, reducing fraud and errors, and reducing the time the product spends in transit. Kenya is now the fourth largest producer of flowers globally (Freightwave, 2018).

Most economic opportunities are in the informal sector. Labour force participation in Kenya is 66.3% or 31.4 million people (World Bank, 2018). For most Kenyans, their work is mostly located in the informal sector, which accounts for 83% of all employment opportunities in Kenya (Africa Research Institute, 2017). The Kenya Bureau of Statistics (2018) estimates that in 2017, the informal sector contributed to 788,000 new jobs, compared to 110,000 jobs created by the formal sector. The trends in the labour market show that these new jobs do not match the number of people entering the labour market. On top of the 1.2 million youths who are NEET (not in education, employment or training), an estimated 700,000 youths enter the labour market annually (British Council, 2017). The total of 1.9 million youths in need of jobs is far above the estimated 900,000 jobs available annually. Kenya's policy target for employment creation is one million jobs per year with 30% of these being formal jobs. Since 2012, the number of new jobs created were consistently below the policy targets.

The ICT sector is the fastest growing sector in Kenya. The ICT sector has been growing steadily, with an average five-year growth rate of 10.8%. Kenya is fast becoming a hub

of ICT innovations, which is changing the structure of the ICT sector. Previously, MNOs dominated the ICT sector, but with increased innovation, digital services such as e-commerce, pay TV and business processing and outsourcing services are starting to outgrow telecommunications. Figure 13 indicates the average GDP growth rates per sector in the economy.

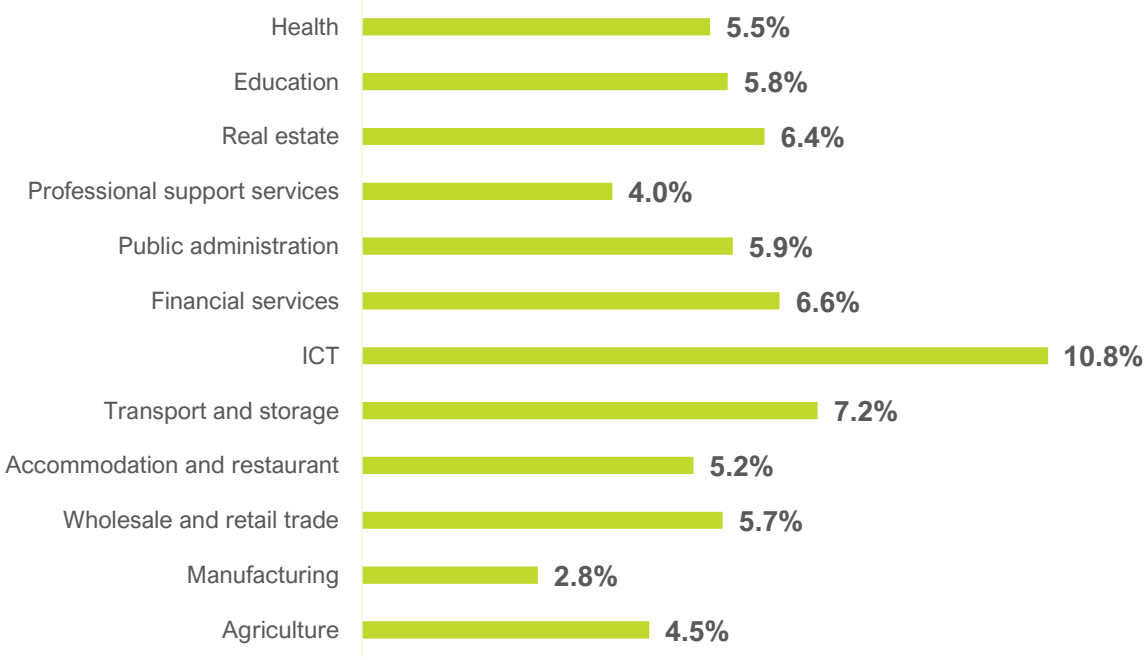

Figure 13: Five-year average GDP growth rate per sector, 2014–2018

Source: Kenyan National Bureau of Statistics, 2019

The growing ICT sector is driving investment and creating ecosystem effects. The Silicon Savanna initiative has been a significant policy effort to establish Kenya as one of the tech hubs in Africa. The recent economic value generated in the ICT sector is drawing the attention of industry players across the world, including Microsoft, which has invested in training 500 developers, IBM's THINKlab focusing on innovations using AI and IoT. Furthermore, the Konza technology park, 60 km south of Nairobi, is a flagship project of Kenya's Vision 2030. This smart-city aimed at promoting Kenya as Africa's ICT hub has attracted investment commitments from big-tech companies, including USD200 million from Huawei. However, progress has been slow after the initial excitement. The Korean government has also committed up to USD100 million to the Kenya Advanced Institute of Science and Technology, which is set to open in 2021. The growth of tech start-ups and innovation labs are contributing to the pool of available talent in the labour market. The ten highest funded start-ups in Kenya have

attracted over USD100 million in investment. Strathmore Business School has responded to the demand by launching a Masters degree in Computer Science. These investments, amongst others, are creating an ecosystem of tech companies necessary to position Kenya as a serious player in the digital economy.

5.2.2. The market for digital skills

Policy

Public policy recognises the importance of ICT in establishing a competitive economy. The government has recognised the importance of the digital sector in meeting its economic policy objectives. The ICT masterplan (2013–2017) has been the main policy framework developed to articulate the role that the ICT sector should play in the economy. The government recently launched its new Digital Economy Blueprint for powering Kenya's transformation. This framework identifies five pillars to drive the digital economy in Kenya:

1. **Digital government.** The government has made significant progress implementing electronic systems for various departments and state-owned entities. These include tax systems, immigration systems, financial management and education systems. The e-Citizen portal that enables citizens to access and pay for services online.
2. **Digital business.** Focused on the key enabling factors that drive the growth of digital businesses. Identifying supportive legislation that ensure contract enforcement on digital channels, and reliable payments infrastructure are some of the key priorities that will enhance growth of digital businesses.
3. **Infrastructure.** The government aims to implement incremental interventions across all levels of infrastructure delivery. This stems from the fact that technology is always evolving and the demands on infrastructure are always increasing.
4. **Innovation driven entrepreneurship.** Kenya aims to position itself as the tech hub in Africa. To achieve this, the government is promoting entrepreneurship in the field of ICT so that the sector becomes a preferred destination of seed and venture capital. The government endeavours to create policies that attract funding toward research and innovation.

5. **Digital skills and values.** The government identified lack of digital skills among the youth as a barrier to employment opportunities. It proposes to implement digital skills training from primary schools to universities. This is done by ensuring that the education curriculum integrates digital skills and values.

An example of an initiative launched under the ICT masterplan is the Ajira skills initiative. Through this initiative, the government intends to roll out at least 1,300 ICT hubs across Kenya by transforming existing government centres into Ajira centres where youths can access internet. To date, just under 200 centres have been set up. The initiative also includes a training component. The training aims to equip the youth with basic socio-emotional skills, introduction to online work skills, digital marketing and basic financial management skills to access online economic opportunities. The programme trains around 10,000 youths per year (Stakeholder interviews, 2019). Despite challenges, Ajira remains an innovative opportunity to connect youth with online work opportunities.

Digital skills a focus in education policy. Education policy (Kenya ICT Masterplan, 2017) identifies initiatives to impart digital skills in the Kenyan education system are at three levels as part of its Digischool programme:

1. **Capacity development of teachers.** This level targets both teachers in training and those already practising. For teachers in training, there has been integration of ICT training at teacher training institutions since 2015. For teachers in practice, the digital literacy programme[37] provides teachers with an e-learning module that will be rolled out on a continuous basis (see *Supply of digital skills*). The aim of this module is to impart the necessary digital skills required for teachers to deliver the curriculum using digital devices.
2. **Integration of ICT in non-ICT subjects.** Under the digital literacy programme, the government aims to introduce digital learning in traditionally non-ICT subjects. The project components include infrastructure provision and capacity development of

37 The Digital Literacy Programme (DLP) aims to make tablets available to all students in primary school to enable curriculum delivery through digital channels. In addition, DLP provides capacity training for teachers (mostly consumer skills-focused) to enable them to use digital technologies in class settings. Digital curriculum development is coordinated at national level by various line ministries.

teachers. This will be complemented with content for digital learning that will impart digital skills at early stages of learning.

3. **ICT centres of excellence.** The government aims to create ICT centres of excellence in five universities that develop high-end ICT skills in Engineering, Computer Science and Information Systems. This is in response to evidence that local industry has expressed dissatisfaction with the quality of skills of entry-level graduates from universities in Kenya. The government will collaborate with the Commission of University Education and Industry to strengthen quality of ICT degrees in all Kenyan universities. As part of this is process, the reward system for technical expertise will be restructured to attract skills from other countries.

Supply of digital skills

Digital literacy programme being rolled out in schools. The government is rolling out a digital literacy programme in primary schools, with Phase 1 now complete. Launched in 2016, it initially targeted Grade 1 students under the theme 'Learning to Use'. The objective of the programme is to create an integrated approach to learning in which teachers use digital devices and content to teach students. At this stage, the students mostly learn consumer digital skills. Over one million devices have been distributed to schools, pre-loaded with educational content and 120,000 teachers have been re-trained. However, this programme has not been free of challenges. Firstly, acquiring devices is costly, delaying the rate at which schools can participate in this initiative. Secondly, teachers are cautious and sometimes unwilling to change their teaching methodologies[38]. Thirdly, without electricity digital devices cannot be charged. This is a particular challenge in rural areas, but most primary schools (86%) do now have access to electricity (Stakeholder interviews, 2019). Phase 2 commenced in July 2019 under the theme 'Using to learn', which emphasises creativity and innovation. The third and final phase will focus on productive use of technology for employment creation.

Computer Science is an elective at upper secondary school. Only at upper secondary school level do students get an opportunity to learn productive and basic developer skills as an elective course. In this two-year course, students

38 In fact, some teachers went on strike, refusing to adopt the new technologies to teach students.

learn about computer hardware and develop basic coding as well as word processing skills. However, only 2% of upper secondary school students take the course. Bearing in mind that only around 50% of students enrol at this level, this represents a very small proportion of youth.

Computer Packages Schools a common way to learn basic digital skills. After students complete secondary school, there are a few months of free time before tertiary courses begin. Many students use this time to acquire additional training at Packages Schools, thus named for the specific software packages or tasks being taught[39]. These schools are largely focused on training students who want to learn the necessary digital skills to attain employment. Many organisations specify in their job advertisements that applicants should have basic computer skills, and a certificate from a Packages School is usually considered sufficient proof. However, from our primary research we learned that the quality of teaching and cost of classes vary greatly. The price to enrol ranges from USD30-100, and in most classes there are two students to a computer, sometimes three. The quality of instruction and available resources impacts greatly on the learning outcomes, with often disappointing results for productive digital skills (Tech Savvy report, 2019).

Tertiary education is the main channel to acquire developer skills, but curriculum mostly theoretical. In Kenya, approximately 15% of graduates obtain a STEM degree. Of those, about 6,000 obtain degrees in Computer Science (Moringa School, 2019). However, the quality of the skills these graduates acquire are typically below industry requirements. University curricula is often mostly theoretical and misaligned with the needs of industry. One reason for this misalignment is the pace at which digital technologies develop. The curriculum developers cannot keep up. On average it takes five years to change a curriculum, while the recommended timeframes for digital skills training programmes is six months to ensure relevancy. The top universities, with many persons in industry mentioning especially the Strathmore Business School, overcome this challenge by providing short courses or by partnering with software providers to supply the curriculum. Short courses can cost up to USD1,000 per course, or focused

39 The most commonly taught packages are Microsoft Office programs, like Word, Excel and PowerPoint. Other computer related topics that were taught include using the internet, email and scanning and printing documents.

post-graduate studies can cost up to USD14,000 (Stakeholder interviews, 2019).

Dedicated skills providers supply skills that are in demand. The gap in the calibre of skills provided by the education system and what industry demands, create opportunities for third-party skills providers. Dedicated skills providers in Kenya, such as Andela, Akirachix or Moringa School, develop curricula that are tailored for the actual work environment. They provide a mix of digital skills and socio-emotional skills that are necessary to succeed in the private sector. Typically, these types of providers are effective at training developer skills. But the model is expensive. It costs an estimated USD5,000 to train an individual student for a year (Stakeholder Interviews, 2019). Since the start of this project, Andela has announced that it will close its training facility for entry-level developers in Kenya, Nigeria and Uganda. The reason is that they are not able to place all their junior engineers. The demand is for experienced senior engineers who they need to source rather than train[40]. This fits the overall narrative during stakeholder interviews that the demand for developers is not met by current tertiary training institutions.

Box 5: Akirachix

Akirachix is a digital skill provider that focuses on teaching young females the developer skills they require to access economic opportunities. The purpose is to increase the number of women who work in the tech industry. The training programme lasts one year, during which the students live on campus. Akirachix provide training in programming, hardware and design. As part of the year-long programme, the students are also taught basic entrepreneurship and business management skills to enable them to start their own initiatives.

The curriculum is hands-on and students have to actively practise the skills that they are taught by the trainers. Akirachix recruits trainers from industry to ensure the skills provided to their students are relevant. As part of the course, students have to complete a one-month internship programme at a company.

In 2018, Akirachix trained 50 students, but received 487 applicants from 15 different countries. At least 80% of those 50 students obtained fulltime employment subsequent to their studies.

For more information see: http://akirachix.com/

40 https://andela.com/insights/the-future-of-andela/

Graduates require further training before they add value. In a 2018 employer survey, the Federation of Kenya Employers found that 64% of employers believe that graduates require additional technical training before they start to add value. This is consistent with what stakeholders discussed during interviews. One stakeholder, a telecoms provider, indicated that it sent 60 candidates for six months of further training at a cost of USD10,000 per candidate, just to ensure that their new hires have the skills they require to do their job. However, the company indicated that, within the subsequent six months, this first cohort had added value that is greater than the investment by developing better cyber security software and new apps. A second cohort is now underway (Stakeholder Interviews, 2019). Interestingly, the training being sought by companies has changed significantly over time. The director of the training centre providing the above training indicated that it has been years since a company sent new recruits for training in MS Office (which used to be frequently requested). The training most in demand now is analytics, cyber security, cloud computing and IoT (Stakeholder interviews, 2019). This indicates a shift in the digital skills required and that fresh graduates are at least equipping themselves with basic productive skills to compete for jobs. It potentially also indicates growth in e-leadership skills within those companies seeking to boost skills in new technologies.

Digital usage statistics may mask some of the deficiencies in the market. The widely used mobile money service, M-Pesa, and related services, have provided a good base for acquiring consumer digital skills. About 83% of Kenyans have made a mobile payment (Findex, 2018). While these payments are predominantly USSD-based, the skills learned from mobile money payments are usually transferable to internet usage. Internet usage statistics shows that 72% of internet users are daily users, while 15% access it weekly (Daterportal, 2019). This may show that Kenya's population is generally tech-savvy. However, our primary research indicated underwhelming results. The average mark among students and teachers for the basic productive skills test was 55%, compared to the benchmark of 80% achievement. Thus, we observed that young people's consumer digital skills do not necessarily translate into productive skills. It is also important to note that individuals consistently tested lowest in the digital safety competency.

Demand for digital skills

Access to basic services require consumer skills. E-government services are creating demand for consumer skills. The Kenyan government has implemented the e-Citizen gateway, which enables people to pay for government services online. Government departments have also started to digitise their processes, which enables them to serve citizens via online channels. For instance, Kenyan citizens can apply for the renewal of their vehicle licence via an e-government platform. In such a case, possessing consumer skills lowers the cost of accessing government services, since people do not need to travel to access physical locations. However, for those without consumer digital skills it is not so simple. Outside the Ministry of Transport, Infrastructure, Housing & Urban Development in Nairobi you will find a microbusiness of tech-savvy young people, sitting at tables with laptops under shade umbrellas, assisting elderly citizens for a fee to renew their vehicle licences via the online platform.

Competitive edge for people with productive skills in the informal sector. As with other facets of life, digital skills can make certain productive processes more efficient. For instance, a tailor at a local market may advertise her new range of clothes via Instagram to a wider audience than those who walk by her stall. However, the qualitative research also uncovered more sophisticated ways in which informal sector workers leverage digital technologies. For instance, Isaac, a backyard mechanic, uses a software package to assist him to do all the administration and financial management for his business. As the economy digitises, business owners will require digital skills to interact with their clients. A survey by the Kenya Bureau of Statistics shows that most SMEs in Kenya (91%) are now using digital devices for client engagements.

Productive skills present opportunities to freelance. The advent of the digital economy is creating new economic opportunities for individuals. If a person has a marketable skill, a trusted digital identity, the ability to build a relationship, and connectivity, then that person can freelance in the gig economy. In 2017, Kenya had an estimated 285,000 active micro-workers (Research ICT Africa, 2018).

Box 6: Samasource – taking microwork to the next level

Samasource is a Silicon Valley-based technology company established in 2008. It creates digitally enabled jobs for Kenyans by linking work in developed economies, mostly the US, with labour in Kenya. In 2015, Samasource opened its first own-operated data centre where it employs almost 2,000 young Kenyans. In this data centre, young adults annotate and tag images for an AI algorithm to learn what it is looking at.

Samasource recruit young people from low-income households with few opportunities. They provide training in three phases. First is 80 hours of intensive training on a product, followed by two to six weeks of slow productivity during which the recruit receives training on the job. After this, the employee receives continuous training on the job to ensure their skills remain current.

For more information see https://www.samasource.com/

Digital skills now required in non-ICT sectors. The matching of consumers and producers by digital platforms is now creating demand for basic productive digital skills in non-ICT sectors. For instance, Twiga Foods is linking farmers in rural areas to markets in Nairobi where prices are higher. The use of digital skills in agriculture is widespread, with 92% of farmers using the internet to conduct their businesses, for example, WhatsApp groups for information, searching for information regarding the weather, and YouTube videos relating to agricultural production (IFC, 2019).

Low remuneration of entry-level developer skills. An entry-level salary for a software developer is approximately USD500 per month. A housekeeper earns USD200 per month, but a teacher can earn an average USD2,000 per month. Thus, this is a relatively low remuneration of such a specialised skill, particularly considering that the annual cost for obtaining developer skills from dedicated skills providers is about USD5,000. The low initial remuneration is probably also indicative of the discount that employers factor in to compensate for the additional training that fresh graduates require (Stakeholder interviews, 2019).

High demand for experienced individuals with developer skills or hybrid skills. In contrast to entry-level developer skills, developers with experience are in high demand. Moringa schools research (2018) showed that in ICT job postings, 69% of job postings required more than two years' experience, compared to 2% of postings that were entry-level. With a few years' experience, a young person can quickly earn more than USD4,000 per month (Stakeholder

interviews, 2019). Similarly, individuals with hybrid skillsets, such as data science or user interface design, are very scarce in the market and are therefore expensive. Unfortunately, individuals with these scarce skills can often find better employment overseas compared to what the local market can offer them.

5.2.3. Conclusion

Investments in infrastructure have resulted in advanced digital rails. The government has built a supportive infrastructure in which the digital ecosystem can thrive. With fibre optic cables and other key infrastructure in place a robust digital economy is developing. Kenya has the largest internet via mobile penetration on the continent. However, last mile access to end consumers is still a challenge.

Young people in Kenya are some of the most digitally savvy youth on the continent. Kenya's population has widely embraced the digital economy. For youth who have grown up with M-Pesa and the ubiquity of mobile phones, digital is the new normal. Young people running businesses in the informal sector make extensive use of apps for business purposes. However, productive skills are not as widespread.

The majority of youth leave school without productive skills. Although the government has prioritised the inclusion of digital skills at primary and secondary schools level, infrastructure and teaching challenges remain. Furthermore, almost half of all students do not attend secondary school and miss the opportunity to learn productive digital skills. Of those who do, very few take a Computer Science course. This has resulted in the rise of unregulated 'computer package' schools emerging to address the problem (often ineffectively). Our qualitative research revealed the low level of productive digital skills amongst youth and teachers.

A digitising informal sector. More than 80% of Kenyans work in the informal sector, which is digitising rapidly. Social media and digital communications channels are widely used, but other business apps and platforms are growing in popularity. Significant opportunities exist for informal sector workers who can strengthen their productive digital skills. The digitisation of the informal sector will change the traditional distinction between formal and informal economic activity.

Kenya has a vibrant tech sector. The tech ecosystem in Kenya is creating diverse opportunities in the digital

economy. The adoption of advanced technologies in non-tech sectors such as agriculture provides new opportunities. For example, the flower value chain in Kenya has been digitised through blockchain technologies and online platforms that connect farmers to markets in urban areas. Efficiency gains in the flower industry has boosted production and export orientation of small-scale farmers, but the digital technologies reforming the agricultural sector are not home grown (they are Dutch).

With a growing digital economy comes the threat of automation. The increased innovation will significantly reshape the economy, potentially leading to job losses through automation. For instance, the rapid adoption of technology may destroy entry-level jobs in farming (such as applying fertiliser). Should productive skills in the formal sector stagnate, young workers will have to turn to the informal sector or the gig economy. The platform economy is and will continue to create a growing number of opportunities.

Skills gap will negatively impact the growth of the tech sector. The growth in the tech sector is driving the demand for high-end developer skills, yet this demand is not being met. Firms are investing significant amounts in in-house training to address the gap or are forced to recruit internationally. With the current limited supply of developer skills, local firms will struggle to develop new innovations and apply cutting-edge technologies.

5.2.4. Opportunities for digital skills development in Kenya

The opportunity to grow skills for the digital economy in Kenya should be considered from two dimensions: short term and long term. In the short term (next five to 10 years) the bulk of incremental income will come from youth acquiring improved productive skills. In the longer term (10 years and beyond) sustained income earning from digital skills will require not only consistently higher productive skills, but world-class developer and e-leadership skills. To build such skills of the requisite quality and scale 10 years from now will require some visionary changes over the next few years.

Boosting the teaching of productive skills. There are several opportunities to improve the acquisition of productive skills by Kenyan youth:

1. Teach a compulsory digitals skills curriculum at secondary school level that focuses on boosting productive skills, as opposed to the more developer skills-orientated content of the current Computer Science curriculum. Our view is that it will be even more impactful and certainly more equitable from a gender perspective if this can already be introduced in primary school. Given infrastructure challenges, this will be more of a stretch. Such a curriculum should focus on mobile-based productive skills as opposed to just computer-based skills.
2. A community-based blended learning approach for youth not in school. Interventions at secondary school will not reach young people who have already left school, or who never attended, or will not receive the training over the next few years while change happens. For them, an accessible space to learn productive skills is ideal. The government, realising this need, has already instituted the Ajira initiative. The combination of good internet access, the availability of trainers who double as digital brokers and employment advisors, and a co-working space provides the best opportunity for the bulk of Kenya's youth who did not benefit from a school-based digital education.
3. Provide Kenyan public servants with the opportunity to obtain a productive skills qualification similar to the ECDL as part of on-the-job training. Not only will this support the e-government agenda, but the mobility of the qualification will enable public servants to feed into the private sector, meeting the skills gap there. This is a relatively low-cost option for Kenya to make a quantum leap in digital skills.

Pushing for advanced developer and e-leadership skills. This is Kenya's longer-term play. It is probably one of a handful of countries in Africa for which this is a realistic option. Again, there are a few complementary opportunities:

1. The growing tech sector provides an opportunity to connect industry with academic institutions to deliver more advanced digital skills at university level. Two universities already have reputations for the ability to link town and gown in the digital space. More support should be provided to support this progress.

2. Increase the exposure of top students to global centres of excellence or leading tech firms, with a strong emphasis on skills transfer. Recent investments by major international tech companies in Kenya by opening local offices and labs also contribute to this exchange. A similar exchange should focus on emerging e-leaders in the public and private sectors.
3. Introduce the teaching of coding skills at selected primary schools. Six countries in Europe have already gone in this direction and so have several other countries, including South Africa. Such a step will have long-term benefits by enlarging the pool from which training institutions can draw potential candidates for advanced developer skills.

5.3. Senegal

In this section, we present pertinent demographic and economic information on Senegal, as well as a high-level overview of the demand for and supply of digital skills in the country. This is followed by a set of key opportunities to develop digital skills in Senegal, which will allow young people to participate more meaningfully in the digital economy.

It should be noted that the Senegal country profile is based on desk research and telephone interviews with key stakeholders, without an in-country visit. Thus, this section is not as extensive as those for Ghana and Kenya.

5.3.1. Country in context

Senegal is a country with a nascent digital economy. The government has recently committed to digitisation through its Digital Senegal 2025 Strategy and MNO-led digital financial services are already widely used for P2P money transfers. There are challenges for implementation of the digitisation strategy, but the political will is evident for developing digital skills to boost employment for young people, particularly in the informal sector.

Youthful population; growing potential labour force. The age structure in Senegal, as with many countries in Africa, is young. More than 40% of Senegal's population is under 15 years old and the median age is 19 (World Bank, 2019). Senegal's population is growing at an annual rate of 2.8% and it is estimated that by 2030 the working-age population (aged 15 or older) will reach 13.5 million, up from 9 million in 2017 (World Bank Group, 2019).

Secondary education enrolment rates lag, but tertiary increasing. Senegal's primary enrolment rate is relatively high at 74%, with reasonable gender parity. However, at 37%, enrolment in secondary education is significantly lower, resulting in the majority of young people entering the labour market with little or no secondary education. According to the ILO, an estimated 36% of youth aged 15–24 are NEET[41]. Females are disproportionately represented within this group – while 29% of young males are NEET, the corresponding figure for young females is 43%. Nevertheless, enrolment in tertiary education has increased over time, from 5.3% in 2005 to 11.2% in 2017 (World Bank, 2019).

Internet connection mostly through mobile technology. At 34%, smartphone penetration in Senegal is on par with Ghana (35%) and higher than in Tanzania (13%), Kenya (30%)[42] and Nigeria (32%). 28% of the Senegalese population are mobile internet subscribers, slightly exceeding the average for West Africa (26%). In 2014, only 6% of respondents aged 15 or older had a mobile money account, but by 2017 this was 32% (World Bank, 2018). Frequency of usage has also increased; in 2014, 36% of respondents reported using a mobile phone five or more times per day but by 2017, this figure had almost doubled to 74%. The number of respondents who 'never' use a mobile phone has fallen dramatically from 14% in 2014 to 0.4% in 2017 (National Statistics Agency of Senegal, 2018).

Relatively low incomes render price of broadband data prohibitively high, despite decreases in recent years. Although the price of 1 GB of mobile broadband data in Senegal (USD3.48) is much lower than the average for West Africa (USD6.2), it is still relatively expensive at 4.4% of monthly income. This is higher than its West African peers Ghana (3.3%) and Nigeria (1.6%) (A4AI, 2018). However, it is important to note that this is still a significant decrease, in 2015 1 GB cost 10.2% of monthly income.

41 (ILOSTAT, 2019)

42 We suspect that this figure underestimates smartphone penetration in Kenya.

	2018
Population access to electricity (2017)	61.7%
Mobile internet subscribers (as % of the population)	28%
Smartphone penetration (population)	34%
Households with a personal computer	16.8%
Mobile broadband cost of data (1 GB as % of monthly GNI per capita)	4.4%

Table 3: Senegalese infrastructure and digital devices statistics, 2018

Source: Pew Research Centre, 2018; World Bank, 2019; GSMA, 2019; A4AI, 2018; ITU, 2018

Sustained robust economic growth; employment concentrated in informal sector. Average annual GDP growth has exceeded 6.5% since 2014 and the forecast for GDP growth remains optimistic, particularly with offshore oil and gas production[43] expected to begin in 2022 (World Bank, 2019a and World Bank, 2019b). The informal sector is of fundamental importance to the economy, with the vast majority (about 97%) of enterprises or registered economic units being informal. Almost 70% of jobs are in the informal sector, with the largest share (43.2%) in trade (ANSD, 2017). Given the size of the working-age population and taking subsequent growth in this population into account, we can conservatively estimate that about 6.7 million working-age people in Senegal are involved in the informal sector – most of whom will need to have at least consumer digital skills in order to continue participating meaningfully.

Services sector largest contributor to GDP and employment. The services sector has been the largest contributor to GDP for the last 35 years[44], and accounts for more than 50% of jobs (formal and informal), rendering it the most significant source of employment in the country (ANSD, 2017).

43 In 2018, the National Institute of Petrol and Gas (INPG) launched to develop national expertise and promote employment in this sector (INPG, 2018).

44 The contribution has recently decreased slightly, from 52.9% in 2013 to 50.4% in 2018 (World Bank, 2019).

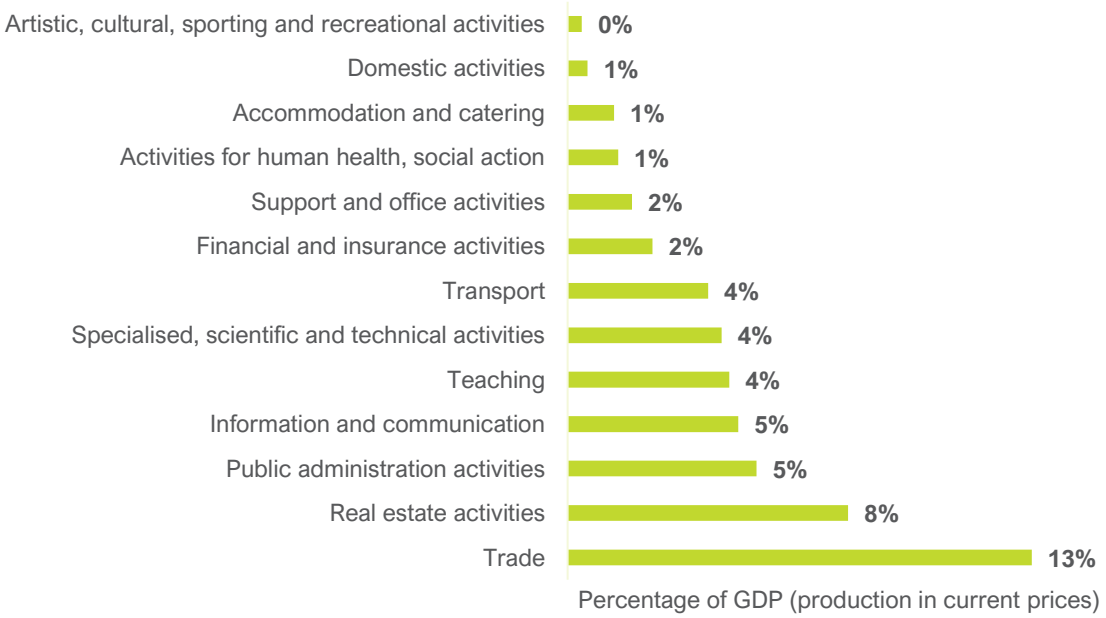

Figure 14: Breakdown of sub-sectors in Services sector by contribution to GDP (2017 provisional)

Source: ANSD, 2019

While the contribution of the services sector to GDP has been declining somewhat recently, the contribution of the primary sector – agriculture, forestry, and fishing (value added) – has increased to 16.6% from 13.7% in 2013. This is due to support programmes, robust external demand and large infrastructure investments linked to the 'Emerging Senegal Plan' or PSE (World Bank, 2019). Nevertheless, the contribution of agriculture, livestock and fisheries to employment has declined from 53.4% of total employment in 2004 to 10.5% in 2016 (ANSD, 2017).

Box 7: Link between mobile phone use and business performance in the informal sector

The use of mobile phones by entrepreneurs in Senegal can be differentiated between those with limited use of mobile phones and those with advanced and intensive use of mobiles for their businesses. The former is strongly represented in the 'small-scale survival-based informal' category of businesses, entities that are "extremely precarious and poor performers", while the latter are categorised as 'digital entrepreneurs' and tend to be among the well-established "top performers".

Berrou et al, 2019

5.3.2. The market for digital skills

Policy

Government recognises importance of digital skills. The PSE, which was launched at the end of 2012, is the Government of Senegal's master plan for development and serves as the backdrop for the country's public policies (ILO, 2018 and World Bank, 2019). Its aim is to transform Senegal into an emerging economy by 2035 and the achievement of its vision rests upon three axes: 1) the structural transformation and growth of the economy; 2) human capital, social protection and sustainable development; and 3) governance, institutions, peace and security. In the PSE, the Government of Senegal explicitly recognises that achieving its objectives requires the development of the digital/ICT sector, resulting in the creation of the Digital Senegal 2025 Strategy, which was adopted in 2016. One of its main objectives[45] is to create at least 35,000 direct jobs in the digital sector by 2025 (Ministry of Postal Services and Telecommunications, 2016).

Recent government reforms aimed at building digital skills. The Government of Senegal recognises the need for the development of digital skills among the population, with 'human capital' as one of the prerequisites identified in the Digital Senegal 2025 Strategy. This includes: the creation of training courses on the analysis of big data, digital innovation competitions, the creation of FabLabs ('digital factories') in the regional capitals, bursaries for digital-related subjects (at least 300 per year) and a programme to train 1,000 digital entrepreneurs per year (Ministry of Postal Services and Telecommunications, 2016). It also rather ambitiously outlines plans to introduce digital methods throughout the teaching curricula, from primary to higher education, by 2020. Stakeholder interviews (2019) indicate that, while there have been a number of interventions implemented, these have been fragmented and limited in scale at primary and secondary school levels. Indeed, according to the World Bank (2019), digital learning has not yet been mainstreamed into the public education system due to resource constraints.

45 The other two main objectives are: a) increase the digital sector's contribution to GDP to 10% by 2025; and b) increase GDP by CFA300 billion, as a result of the impact of digital technology on other key sectors (Ministry of PST, 2016).

Supply of digital skills

Limited infrastructure challenge to acquisition of digital skills in schools. Only 37% of primary schools in Senegal have access to electricity[46], 27.5% have access to computers and 16.5% have access to the internet for pedagogical purposes (UIS, 2017). In the absence of these crucial resources, teaching primary school students even basic consumer digital skills will be challenging. Access to infrastructure and hardware is better at secondary school level, where the vast majority have access to electricity and over 80% of both lower and upper secondary schools have access to the internet for pedagogical purposes (UIS, 2017). These figures are higher than the regional averages on all fronts and are promising from a digital skills acquisition perspective, although stakeholder interviews indicate that digital skills teaching at the secondary level is often limited to consumer skills, such as how to use hardware and the internet. Moreover, according to the World Bank (2019), private schools in Senegal have endeavoured to 'fill the gap' by offering digital training opportunities that have, in some cases, become "an easy marketing element to attract students from affluent families". Stakeholder interviews also indicate that the acquisition of socio-emotional skills, critical developing digital skills, is limited by the prevalence of 'traditional' methods of teaching, which rely on rote learning and do not teach students to ask critical questions and explore innovative solutions.

Government interventions focused on higher education. In the context of the PSE, even prior to the implementation of the Digital Senegal 2025 Strategy, the Government of Senegal had already put a national education and research network in place, which has shared access of 2 × 155 Mbps, and launched the Virtual University of Senegal (UVS) with its national network of open digital spaces (ENOs) (Ministry of Postal Services and Telecommunications, 2016). The UVS offers 25 courses ranging for Bachelor level to Doctorate level, on a range of subjects including Applied Mathematics and Computer Science, Application Development and Digital Communication (Diallo, 2018). Box 8 provides more information on the UVS.

46 In comparison, the regional average is 35%.

Box 8: The Virtual University of Senegal

The Virtual University of Senegal (Université Virtuelle du Sénégal or UVS) was established in 2013 with the objective of ensuring equitable access to higher education. The UVS, its physical terminals and ENOs (Espace Numérique Ouvert or Open Digital Spaces) were partly established through funding from the African Development Bank, which also aims to provide 5,000 students with laptops through the 'one student, one PC' programme.

Students can choose from five different fields of study: Applied Mathematics and IT, Economic and Management Sciences, English, Legal and Political Sciences and Sociology. Of registered students, 30% are studying degrees in the STEM and digital fields (UVS, 2019).

The UVS uses a blended learning approach, a combination of in-person classroom teaching and online training, with progressively less reliance on classroom teaching as students progress within their degree programme. The number of registered UVS students has grown considerably over time – from about 2,000 in the 2013-2014 academic year to more than 28,000 in 2017-2018 (Ting and Daniels, 2019). Despite this increase, the UVS has faced challenges in converting registered students into graduates. In 2019, 950 students obtained their Bachelor's degree (Enseignement Supérieur, Recherche et Innovation, 2019).

Consumer digital skills base improving, driven by access to mobile phones. According to the Global Findex (2017), in 2014, only 12% of the population aged 15 and above made or received digital payments in the past year and only 1% used the internet to pay bills or to buy something online. By 2017, these figures had risen to 40% and 10%, respectively. These figures, driven by the proliferation of mobiles phones, indicate that digital consumer skills have significantly increased in Senegal. There also seems to be a correlation between consumer skills and completing secondary school as 51% of respondents with this level of education had made or received a digital payment in the past year. Given the importance of foundational skills in the acquisition of digital skills, this is not surprising. However, it may indicate that the Government of Senegal's interventions at the secondary level of education are resulting in improved levels of digital skills. However, it is noteworthy that even people who are illiterate can use WhatsApp to communicate by using the voice recording function (Stakeholder interviews, 2019).

Limited availability of developer and e-leadership skills among youth. Stakeholder consultations reveal that beyond digital interaction, basic browsing and some basic MS Office skills, other aspects are lacking, such as creating PowerPoint presentations (Stakeholder interviews, 2019). CTIC, Dakar's

main Innovation Hub, had to refocus its entrepreneurship programme from digital to general due to the lack of tech-enabled start-ups or ideas. This indicates the lack of developer and e-leadership skills among youth at present.

Demand for digital skills

Present demand for digital skills still limited. Only 0.4% of enterprises in Senegal are classified as operating in the transport and telecommunications sector, which serves as the catch-all category for ICT in Senegal's national statistics (ANSD, 2017). The stakeholder interviews revealed that for many non-ICT companies, 'going digital' means creating a Facebook page or a basic website, requiring only productive digital skills at most. The digital transformation in Senegal has yet to move companies to make changes to internal processes and systems. Many companies do not know what they need or what might be possible, indicating low levels of e-leadership skills within non-ICT firms. As such, it is not surprising that only 3% of enterprises cite 'lack of qualified personnel' as the most significant constraint (for comparative purposes, 23.5% cite 'lack of demand') (ANSD, 2017).

Demand increasing in some formal sectors. Nevertheless, stakeholder interviews with HR managers indicate that demand for developer digital skills is increasing in specific sectors, such as telecommunications, internet, financial services and technology companies as well as in the public sector. A semantic analysis of 83 job offers published on the internet between January 2017 and November 2018, conducted by the ILO (2018), indicates that the most-demanded job title – sought by more than 70% of the listings – is 'developer'. The second largest category is 'project manager', followed by 'database administrator'. Sonatel-Orange, the largest telecommunications provider in Senegal, is building its own pipeline of developer skills through the Sonatel Academy Coding School, which is the first free coding school in the country (Sonatel, 2018). Stakeholder interviews also reveal that the demand for productive skills, such as social media management and digital marketing roles, is increasing.

Consumer and productive digital skills already relevant in informal sector. Stakeholder interviews indicate that the informal sector is also digitising and thus, the demand for productive digital skills is growing. The use of social media platforms for marketing goods and services and messaging apps for communicating with customers is commonplace. Indeed, at present, the development of e-commerce (except for major platforms such as Jumia) is concentrated in the

informal sector, expanding through social networks, aggregator sites and private classified sites (UNCTAD, 2018). The Senegalese CoinAfrique, for example, provides a platform for classified advertisements; since its launch in 2015, it has been downloaded by more than 1.4 million people across 13 countries[47].

Proliferation of payments through mobile phone. On the one hand, stakeholder interviews indicate that customers in Senegal prefer to pay for e-commerce goods and services in person (and in cash), to confirm the quality of the goods. This preference is confirmed by the Global Findex (2017), which indicates that of those who paid online, only 3% were purchases of goods. On the other hand, stakeholder interviews also reveal that small retailers and merchants in informal markets are already making increasing use of mobile money (Orange Money is the dominant provider). This in turn drives the demand for digital skills, because even if the transaction takes place face to face, it still requires consumer and productive skills to execute. Moreover, payments through mobile phone are even making headway in agriculture. The Global Findex (2017) reveals that while in 2014, only 2% of payment recipients received payments for agricultural products through a mobile phone. By 2017, this figure had increased significantly to 21% of payment recipients who received payments for agricultural products through a mobile phone. Those who receive money digitally are more likely to spend it digitally[48], thus pushing agricultural producers to develop consumer and even producer skills in order to participate in the digitising informal sector.

Expected increase in future demand. The Digital Senegal 2025 Strategy includes a wide range of projects aimed at increasing the number of digital jobs, directly through its 'Start-up Senegal' project which aims to set up 50 new digital enterprises per year and other ICT-specific jobs, and more broadly, by leveraging technology to improve efficiency in other sectors. This includes the agricultural sector, trade, financial services, public health and education (Ministry of Postal Services and Telecommunications, 2016). E-government will also drive further demand for digital skills. The government plans to get 40% of its administrative services online by 2025, for instance through building permit applications and birth registrations. As part of this initiative,

47 https://www.coinafrique.com/.

48 Digital financial services measurement framework, Insight2impact, 2019 https://i2ifacility.org/system/documents/files/000/000/102/original/DIGITAL_DFS.pdf?1566351490

the government plans to build 'Digital Centres' in each of the 45 regions of the country to allow citizens to access online services more easily (Ecofin Agency, 2019). These interventions are likely to result in an increase in demand for all levels of digital skills.

Cultural factors constrain women's participation in digital sector. Stakeholder interviews emphasise that cultural factors limit women's willingness or ability to acquire higher-end digital skills. This includes family commitments and expectations, self-confidence and that working late on projects is socially unacceptable for women. For example, almost none of the 155 entrepreneurs that the CTIC Dakar Innovation Hub has incubated so far has been women and there is a perceived lack of strong female role models in the digital sector. In an attempt to redress the gender imbalance, Sonatel/Orange's Women's Digital Centre offers productive and socio-emotional skills training to small cohorts of young women.

5.3.3. Conclusion

Nascent digital economy and digital/ICT sector. Senegal has made significant progress in digital connectivity and is on par with Ghana in terms of smartphone penetration. Nevertheless, Senegal's preparation for the digital economy lags behind that of Ghana and significantly behind Kenya. Given the small size of the ICT sector and that the application of digital technologies is still concentrated in the telecommunications and financial services sectors, the current gap between the demand for and supply of digital skills in Senegal is relatively small – simply because the demand for digital skills is still limited.

Government committed to digital transformation; constrained by lack of resources. Through the PSE and the Digital Senegal 2025 Strategy, the Government of Senegal has demonstrated its strong commitment to digital transformation. While this commitment is a necessary step in the right direction, significant infrastructure challenges remain as well as a lack of a cadre of digitally skilled developers and e-leaders to implement.

Expected increase in formal sector demand for digital skills. In the formal sector, the growth in the demand for enhanced productive and developer digital skills is likely to come from three sources: MNOs (forced to adjust business models as revenue from voice declines and government regulates data costs more strictly), financial service providers (seeking to cut costs through digitisation),

and the public sector to implement the Digital Senegal 2025 plan including e-government services.

Integration of digital skills into school curriculum lagging. Despite the Government of Senegal's stated intention to incorporate ICT into the school curriculum, this intention has not yet led to widespread implementation. Given that primary school enrolment significantly exceeds secondary school enrolment, including ICT in the compulsory curriculum of primary schools could have a major impact on digital skills acquisition among Senegal's young population.

Informal sector already digitising. The proliferation of mobile phone usage and digital payments illustrates the extent to which the informal sector has already digitised – and the extent of digitisation is likely to grow. Given the low rate of secondary school enrolment, young people who have fallen through the school net and will need to find opportunities to learn or teach themselves digital skills.

Inadequate digital skills training for bulk of working-age young people. Over the next decade, the majority of young people in the working-age population (aged 15–35 years) will have no or inadequate digital skills training from the formal education system. Most will find themselves entering the informal sector and needing digital skills, as these become standard for economic interactions at all levels of society. A key group will be young people who can find opportunities to learn digital skills and enter the digital economy, be that as entrepreneurs, rising stars in increasingly digital firms and e-government enterprises, or as independent gig workers.

5.3.4. Opportunities for digital skills development in Senegal

- **Reduce mobile data costs.** The bulk of the population of young people who have received no or inadequate digital skills training at school will need to acquire digital skills through self-learning or via assisted learning interventions. The most efficient way for young people to acquire digital skills in this way will be via smartphone, given the relatively high smartphone penetration and connectivity in Senegal. Nevertheless, mobile data is still prohibitively expensive for many – thus, the biggest contribution to enabling their learning will be through the reduction of mobile data costs or the creation of free public WiFi hotspots.

- **Support digital work and community centres.** Digital work and community centres (such as the UVS's ENOs) can be repurposed to become the 'innovation hubs' for the informal sector, where 'digital brokers' can facilitate learning and provide guidance for young people who have fallen through the school-based education gap to access opportunities in the digital economy. Creating pilot centres and starting the training of these digital brokers should be a priority – especially given that they can also serve as digital skills trainers in schools.
- **Roll out ICDL for young people in government departments.** The ICDL is an established curriculum that can be internally benchmarked. Enrolling all public sector workers under 35, and others on an opt-in basis, will assist in enabling the Government of Senegal to achieve its e-government objectives. Many of the public employees who attain this qualification are likely to be recruited by private companies later on, leading to the dissemination of these skills across the economy.
- **Support development and roll out of compulsory IT curriculum at primary and secondary school levels.** It is the Government of Senegal's intention to introduce digital education throughout the primary and secondary school levels, but the progress of this initiative has been slow due to lack of resources. Providing support to this initiative and making the case for adding digital education to the primary curriculum is crucial for the future of young people to participate in a digital economy.
- **Create a centre of excellence at a tertiary institution.** To support the creation of a pool of advanced developer skills, it will be necessary to create a centre of excellence at tertiary level. Although this intervention is necessary, it does not constitute an immediate or urgent priority for the private sector to support and thus requires an external catalyst.

6. Conclusion

This report has outlined the skills that youth in Africa require for employment in a digital world. We explored the ways in which the digital economy is reshaping work opportunities on the continent and the content of jobs. The skills for a digital economy framework was presented, with four functional levels: consumer skills, productive skills, developer skills and e-leadership skills. We then presented a typology for learning digital skills and the challenges unique to learning digital skills in Africa. Our assessment of learning types provided insights on which approaches are best suited to learn digital skills at scale, which are best for employment and cost-effectiveness. Three country diagnostics were presented for Ghana, Kenya and Senegal, highlighting the supply and demand of digital skills, and opportunities for interventions.

Below is a summary of the key findings and recommendations on where the Mastercard Foundation should focus as it evolves its strategy to develop skills for young Africans to generate employment and income in a digital economy.

Key findings: Digital skills and content of jobs

- **The informal sector,** where 80%+ of African youth earn their income**, is a social media economy:** To function on the social media platforms and use digital payments require basic consumer digital skills. These are mostly self-taught or acquired from product induction.
- The mobile phone is the digital device of choice or necessity for business purposes in the informal sector.
- **Digitally enabled platform business models** that deliver industrial goods and services **create new income opportunities** that require consumer and some productive digital skills.
- Most **formal sector jobs** and more informal sector jobs require growing levels of productive digital skills.
- **Workers in the gig economy,** where digital goods and services are produced and traded, require more advanced productive skills, but the income opportunities in SSA are limited.
- The small but growing **ICT and tech sector** requires advanced digital developer skills that are not currently produced by either public or private education in our

target countries. There is a **strategic gap in developer skills,** which limits the ability of target countries to reach middle income status.

- **Public and private leaders and innovators** are required to navigate and shape systems and business models able to thrive in the digital economy. E-leadership skills have become essential for their success.

Key findings: Learning digital skills at scale

- **Teaching coding at primary school.** More countries teach coding at primary schools, which provides equitable access and increases the pool of students that will pursue digital skills later in school and tertiary education.
- **Missed opportunity to teach digital skills in secondary school.** ICT is more than Computer Science, but is often reduced to this, and an insufficient number of students choose it as an elective since it is not compulsory.
- **Digital by default at tertiary level.** The institutions that require students to submit work digitally produce graduates with stronger productive digital skills.
- **Certification in ICDL or similar.** Quality standards can be raised by introducing certification in computer-based digital skills. This has been widely used in Europe to increase productive skills of school graduates and public sector staff.
- **Learning apps for all subjects.** Successful apps such as Khan Academy provide access to high-quality content for all ages and subjects. Some African Ed-Tech apps are now available but have not achieved scale. However, these apps position themselves as providing solutions for Africa: context-appropriate content in local languages, low-data usage or offline content.
- **Foundational skills can be strengthened through tech-assisted learning.** Programmes that learn a student's level of knowledge and set progressively harder challenges have proved effective at boosting foundational skills, especially in Mathematics. This can overcome the challenge of large class sizes and varying learning abilities.

Key findings: Country diagnostics

The country diagnostics in Ghana, Kenya and Senegal reveal both common and distinctive opportunities for increasing digital skills. Common opportunities include significantly increasing the teaching of productive skills at secondary schools. Common obstacles to achieving this are the absence of an appropriate curriculum, which will include the teaching of smartphone-appropriate productive skills, and the fact that learning digital skills is not compulsory.

The labour market reality across all three countries is that the bulk of the youth beyond school age did not receive adequate training in productive skills. For the enterprising amongst them, the best option is the creation of open digital spaces, staffed by trained digital brokers able to train and intermediate between attendees and the digital world. The function and importance of the digital broker is expanding across Africa and requires more attention and focus. The opportunity to teach productive skills to public servants is also a common relatively low-cost opportunity at scale for all three countries.

Country-level findings: Ghana

- The government is committed to digitisation, but implementation is a challenge.
- ICT is compulsory at secondary schools, but the education system faces sever challenges to resource and teach digital skills in practice.
- Quality of graduate digital skills (secondary and tertiary) is insufficient to meet current demand.
- There is a growing demand for high-end developer digital skills, which is currently unmet.
- Consumer digital skills are flourishing, driven by mobile devices, which are the gateway to the internet.
- The informal sector is digitising, thus productive digital skills are needed to take advantage of this opportunity.

Country-level findings: Kenya

- Government investment in infrastructure has resulted in advanced digital rails and it has the largest internet via mobile penetration on the continent.
- Kenyan youth are some of the most tech-savvy on the continent, but productive skills are lagging. Private

sector provision through Packages Schools seeks to fill the gap.

- The informal sector is digitising and uses a wide spectrum of digital technologies, but primarily social media and business apps.
- The country has a vibrant tech sector, but high-end developer skills are needed to keep the competitive edge and keep innovating. Limited supply of needed developer skills from universities.
- For youth out of school, open community-based digital spaces to access technology can increase the reach, such as the Ajira programme.

Country-level findings: Senegal

- There is significant recent government commitment to digitising, including e-government, but implementation is a challenge.
- In the small but growing formal ICT sector, demand for developer skills is currently limited to tech and banking sectors. Supply is low and few learning centres exist to build developer skills, plus low salaries are offered for entry-level jobs.
- The informal sector is digitising, driven by mobile money and social media but most youth miss the opportunity to learn formally. Although most secondary schools have electricity and some infrastructure, a large proportion of youth do not attend secondary school and ICT is not currently compulsory.
- Senegal's virtual university established 'Open Digital Spaces' for students to learn at a distance, but for youth who are not enrolled and left school without adequate digital skills training, there are few opportunities to learn.

Summary recommendation

- **Digital as baseline skills for earning.** Digital skills are critical to earn income in the future economy – formal and informal sectors are digitising.
- **Do not focus on consumer skills**. Consumer skills are mostly self-taught on mobile devices. This will continue as the prevalence of smartphones grows and cost of data reduces.
- **Two-pronged approach** is necessary: 1) a short-term strategy that focuses on the optimal acquisition of productive skills for youth in school and those who have

already left school; and 2) a long-term strategy is needed that aims to build top class developer skills and e-leadership skills to drive the digital economy in African countries at every level.

- **Youth in school**. The most cost-effective strategy to achieve both short- and longer-term objectives is to improve the teaching and practice of digital skills in the public-school system. Teaching coding in primary school is a moon-shot, stretch goal, but one that will be a game changer for the future of jobs in Africa.
- **Youth out of school**. For youth who have already left school without adequate digital skills training as well as those who will leave school in the short term while the system is still being upgraded – create digital open spaces that provide training, as well as online access for entertainment and working.
- **Youth in employment**. The best opportunity to upscale the digital skills of youth in employment at scale (recognising that private firms will do their own on-the-job training) is to focus on government and require all employees below a certain age to take the ICDL and provide them with a certification. Such a certificate will make them attractive to public and private employers alike.
- **Youth in tertiary education**. A sea change is needed in the incentives for students to take STEM courses as well as the content and orientation of courses. The link between training entities and industry must be dramatically increased and entities that do this well – of which there are a few examples – must be celebrated and encouraged.
- **Developer skills**. This is where a long-term strategy is required. We believe the single biggest change will be to launch a programme to introduce teaching of coding in primary schools. This will start to change the mindset of youth and also create a large enough pool of potential coders to build the digital future. Such a programme should start with pilot schools and gradually extend to all primary schools and later, secondary schools.
- **Optimising digital training capacity**: A lack of sufficiently trained digital teachers is a global problem not just an African one. The answer lies in changing the notion of a teacher to incorporate persons who already work and want to expand their income. There is no reason why the facilitators at open digital spaces cannot also teach digital skills in schools. A comprehensive and pragmatic approach is now required.

7. Appendices

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7.2. Stakeholder interview list

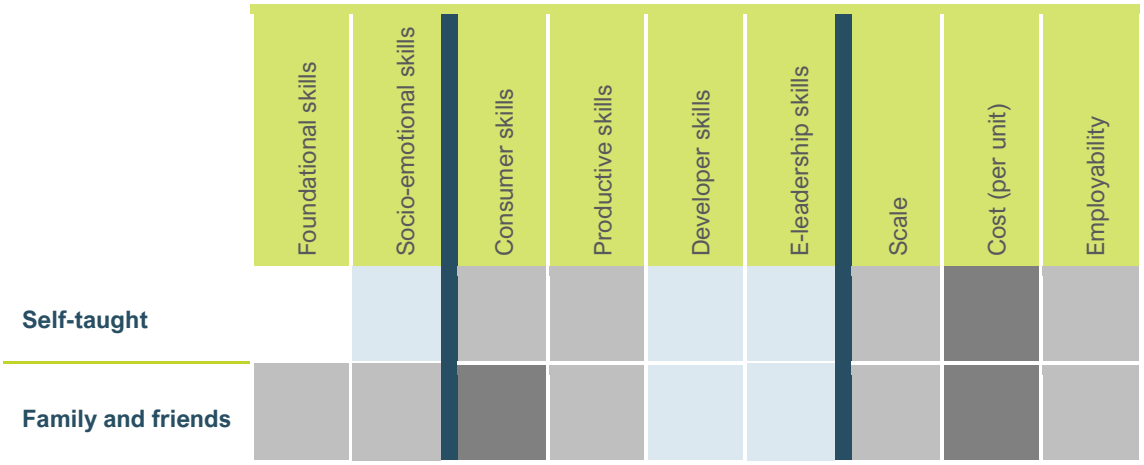
Person/s	Position	Organisation	Country
Aarti Salhjee and Sunyoung Hwang	Education Specialists	Unicef	Ghana
Abdul Latif Issahaku	Data and Devices	MTN	Ghana
Abdul-Nasser Alidu	Entrepreneurship Director	Ashesi University	Ghana
Alex Mbogo	Business Management Advisor	PWC Kenya	Kenya
Alex Muiruki	Associate Director	PWC Kenya	Kenya
Amma Benneh-Amponsah	Human Resources Executive	MTN	Ghana
Andrew Rudge	CEO	The Reach Trust	South Africa
Anne Gwachoka	Associate	BFA	Kenya
Ariane Delannoy	Chief Researcher	SALDRU	South Africa
Arianne Fisher	Managing Director, East Africa	Shortlist	Kenya
Arnold Kavaarpuo	Country Director	Jumo	Ghana
Ashwin Ravichandran	Managing Director	MEST Africa	Ghana
Bitilokho Ndiaye	Gender Technical Advisor	Ministry of Telecommunications, Postal Services and Digital Economy, Senegal	Senegal
Bitange Ndemo	Professor of Entrepreneurship	University of Nairobi	Kenya
Cecil Senna Nutakor	Founder	e-Campus	Ghana
Charles Gichira	Director: ICT	Teachers Service Commission	Kenya
Chris Otundo	Senior Manager – Talent, Acquisition and Capability	Safaricomm	Kenya
Christine Ukpere	Consultant	Google	Kenya

Person/s	Position	Organisation	Country
Divya Nambiar	Researcher	Oxford Policy Management	India
Dr Joseph Sevilla	Director	iLab Africa	Kenya
Dr Kobby Mensah	Lecturer, Digital Marketing	University of Ghana Business School	Ghana
Ebo Richardson	Chief Information Officer	Barclays	Ghana
Ehud Gachugu	Senior Technical Advisor	Kenya Youth Employment and Skills	Kenya
Elizabeth Kathure	Developer Relations Associate	Africa is Talking	Kenya
Frances Nobel-Nkruma	HR Director	World Vision	Ghana
Gary Bannatyne	Managing Director	The Digital Academy	South Africa
Gideon Brefo	Head of Operations	Hapaweb	Ghana
Hamoud Abdel Wedoud Kamil	Senior Education Specialist	World Bank	Senegal
Hon Joseph Mucheru	Cabinet Secretary	Ministry of Information, Communications and Technology, Kenya	Kenya
Janet Boakye	Relationship and Communications	Developers in Vogue	Ghana
Joan Thuo	Human Resources	IBM	Kenya
Joe Louis	Director: Technical Services	Ghana Youth Employment Agency	Ghana
Joseph Sevilla	Director	iLabs, Strathmore University	Kenya
Leona Craffert	Director	University of Western Cape - CoLab	South Africa
Linda Kamau	Co-founder	Akirachix	Kenya
Linda Narah	General Manager	Shared Services	Ghana
Maeghan Ray	Digital Health, e-Health and M-Health Technical Consultant	WHO Digital Projects	Kenya

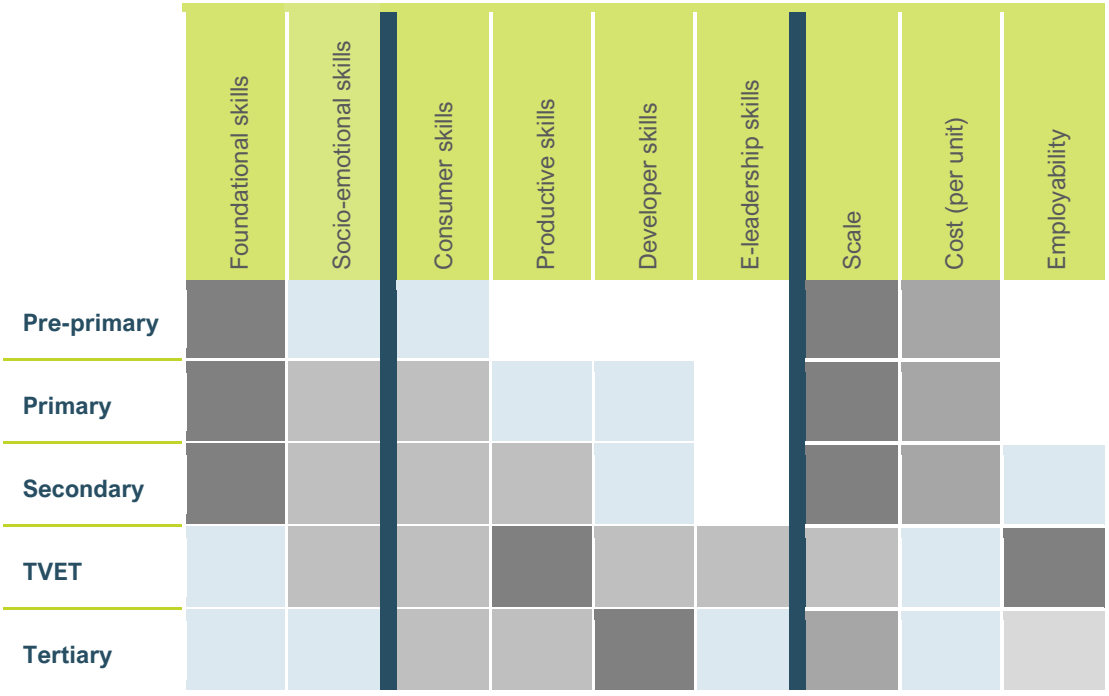
Person/s	Position	Organisation	Country
Makmoud Camara	CEO and Founder	Chez Keys Job	Senegal
Mamadou Ndoye	Digital Marketing Manager	Ringier One Africa Media (ROAM) Senegal	Senegal
Patrick Karanja	Consultant	Rockerfeller Foundation	Kenya
Philip Chikwiramakomo	Senior Director: International Growth and Partnerships	Samsource	Kenya
Professor Bitange Ndemo	Professor	University of Nairobi	Kenya
Raymond Mendy	Director-General	CTIC Dakar	Senegal
Reg Orton	Co-founder and CTO	BRCK	Kenya
Regina Honu	CEO	Soronko Academy	Ghana
Rita Wahome	Director: Staffing	Teachers Service Commission	Kenya
Rob Urquhart	Director	Harambee	South Africa
Robert Davids	Deputy Director: Digital Economy	Western Cape Government	South Africa
Rokhaya Solange Mbengue	Head of Corporate Social Responsibility (CSR) and Partnership	Orange Sonatel Senegal	Senegal
Rose Gichure	Group Talent Manager and HRBP	Cellulant	Kenya
Sandra Abrokwa	Country Director	Viamo	Ghana
Tounwende Alain Sawadogo	Senior Digital Policy Specialist, Infrastructure Practice Group (GGI)	World Bank	Senegal
Victor Asante	Senior Manager, Research, Monitoring and Evaluation	Ghana Investment Fund for Electronic Communications	Ghana
Zaki B Khoury	Senior Technology and Strategy Advisor: Digital Development	World Bank	Senegal

7.3. Learning Assessment matrix

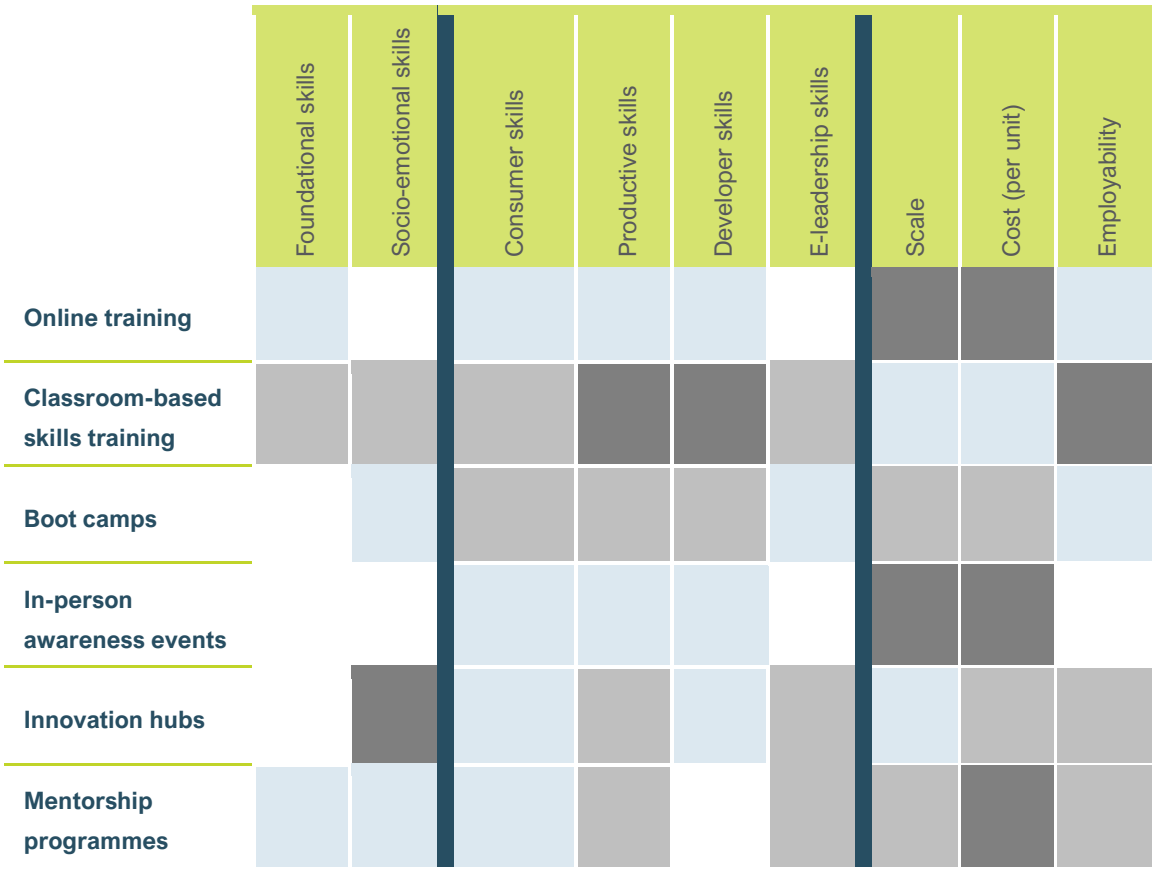
Self-learning evaluation



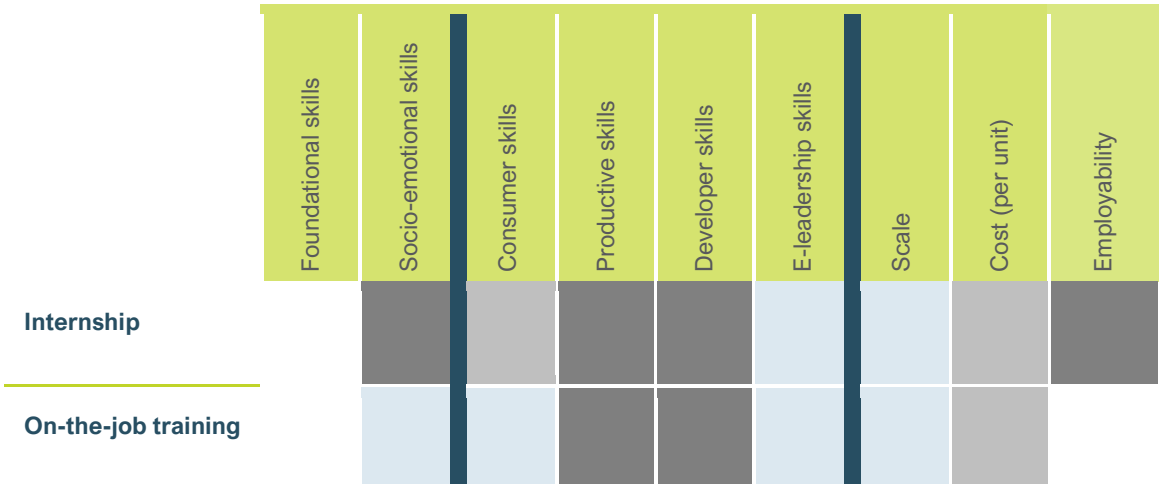
Formal education evaluation



Dedicated skills providers evaluation



Employers' evaluation



Product induction evaluation