WORLD ECONOMIC FORUM

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Executive Briefing

The Future of Jobs and Skills in Africa

Preparing the Region for the Fourth Industrial Revolution

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Preface

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Education and work in Sub-Saharan Africa will determine the livelihoods of nearly a billion people in the region and drive growth and development for generations to come. As one of the youngest populations in the world, it is imperative that adequate investments are made in education and learning that holds value in the labour market and prepares citizens for the world of tomorrow. In addition, as the global transformation of work unfolds in Africa, policymakers, business leaders and workers must bve prepared to proactively manage this period of transition.

At the World Economic Forum, we seek to support leaders and the public by sharing the latest insights on the changes underway. This *Executive Briefing on the Future of Jobs and Skills in Africa* uses the latest available data, including through a research partnership with LinkedIn, to provide a concise overview of the region's education, skills and jobs agenda.

In addition to providing insights on current trends and future projections, the World Economic Forum also aims to provide a platform for multistakeholder collaboration to close skills gaps and prepare for the future of work. The *Africa Skills Initiative* serves as such a platform, consolidating the latest insights, bringing together different businesses' efforts to address future-oriented skills development and supporting constructive public-private dialogue for urgent and fundamental reform of education systems and labour policies to prepare workforces for the future of jobs.

This *Executive Briefing* is intended as a practical guide for leaders from business, government, civil society and the education sector to plan for the needs of the future, including those involved in the *Africa Skills Initiative*. It is also a call to action to the region's leaders to address urgently the reforms that are needed today to ensure that Africa's young people can harness the new opportunities that are coming their way.

Key Findings

- The World Economic Forum's Human Capital Index finds that Sub-Saharan Africa currently only captures 55% of its human capital potential, compared to a global average of 65%. With more than 60% of its population under the age of 25, Sub-Saharan Africa is the world's youngest region. By 2030, the continent's working-age population is set to increase by two-thirds, from 370 million adults in 2010 to over 600 million in 2030.

- The share of this population with at least a secondary education is set to increase from 36% in 2010 to 52% in 2030. As 15 to 20 million increasingly well-educated young people are expected to join the African workforce every year for the next three decades, delivering the ecosystem for quality jobs – and future skills to match – will be imperative for fully leveraging the continent's demographic dividend.

- While it is predicted that 41% of all work activities in South Africa are susceptible to automation, as are 44% in Ethiopia, 46% in Nigeria and 52% in Kenya; this is likely moderated by comparatively low labour costs and offset by new job creation. Despite this longer window of opportunity, the region's capacity to adapt to further job disruption is a concern, although there are important nuances at the country level.

- Employers across the region already identify inadequately skilled workforces as a major constraint to their businesses, including 41% of all firms in Tanzania, 30% in Kenya, 9% in South Africa and 6% in Nigeria. This pattern may get worse in the future. In South Africa alone, 39% of core skills required across occupations will be wholly different by 2020.

- Often this skills instability stems from the fact that many jobs in the region are becoming more intense in their use of digital technologies. Average ICT intensity of jobs in South Africa increased by 26% over the last decade, while 6.7% of all formal sector employment in Ghana and 18.4% of all formal sector employment in Kenya occurs in occupations with high ICT intensity.

- Currently trending professions on the continent include the creative industries, food technologists, 3D designers, data centre workers and care, education and health workers, according to our analysis in partnership with LinkedIn. In the longer term, there is strong job growth potential in hard and soft infrastructure, green jobs, the ICT sector and through new work formats.

- The greatest long-term benefits of ICT intensive jobs in the region are likely to be not in the lower-skilled delivery of digital products or services but in digital design, creation and engineering. To build a pipeline of future skills, Africa's educators should design future-ready curricula that encourage critical thinking, creativity and emotional intelligence as well as accelerate acquisition of digital and STEM skills to match the way people will work and collaborate in the Fourth Industrial Revolution.

- The Forum's *Africa Skills Initiative* provides relevant new insights, brings together different businesses' efforts to address future-oriented skills development and supports constructive public-private dialogue for urgent and fundamental reform of education systems and labour policies to prepare workforces for the future of jobs.

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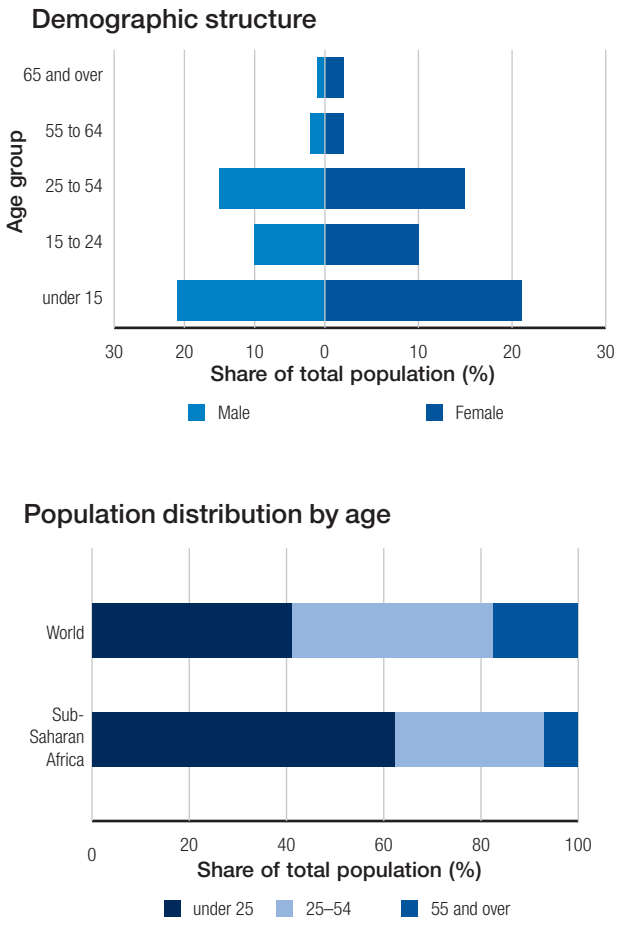
Introduction

Sub-Saharan Africa is home to 13% of the world's working-age population; a number that is set to increase to more than 17% by 2030, the world's second largest after Asia. With more than 60% of its population under the age of 25, Sub-Saharan Africa is already the world's youngest region today – and, by 2030, will be home to more than one-quarter of the world's total under-25 population. Over this period, the region is projected to expand the size of its workforce by more than the rest of the world combined,[1] as its young population, the best-educated and globally connected the continent has ever had, enters the world of work.

By leveraging this demographic opportunity, Sub-Saharan Africa has the potential to unleash new economic possibilities created by future industries and labour markets, dramatically raising labour productivity and per capita incomes, diversifying its economy, and becoming an engine for stable economic growth, high-skilled talent and job creation for decades to come.

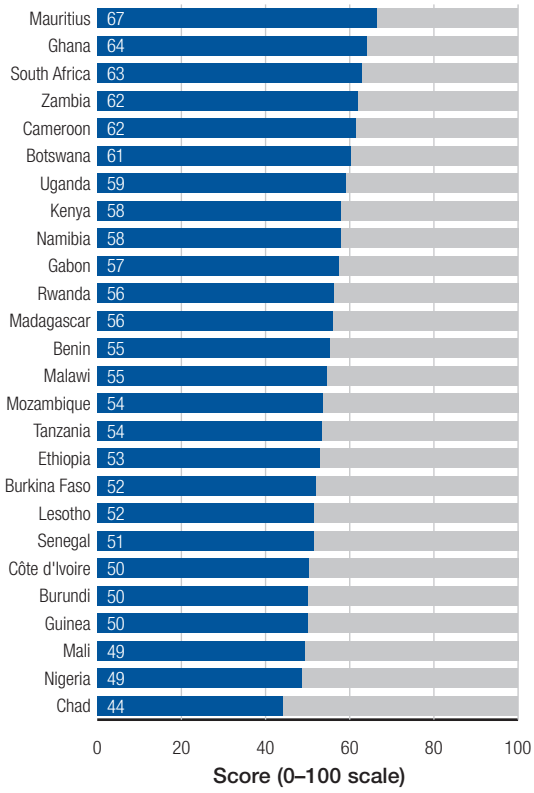
Today, however, Sub-Saharan Africa is far removed from making optimal use of its human capital potential and under-prepared for the impending disruption to jobs and skills brought about by the Fourth Industrial Revolution.[2] The World Economic Forum's Human Capital Index, which measures the extent to which countries and economies optimize their human capital through education and skills development and its deployment throughout the life-course, finds that Sub-Saharan Africa, on average, currently only captures 55% of its full human capital potential, compared to a global average of 65%, ranging from 67 to 63% in Mauritius, Ghana and South Africa to only 49 to 44% in Mali, Nigeria and Chad (Figure 2).[3]

Figure 1: Sub-Saharan Africa's demographic structure



Source: United Nations Population Division.

Figure 2: Human capital optimization in Africa

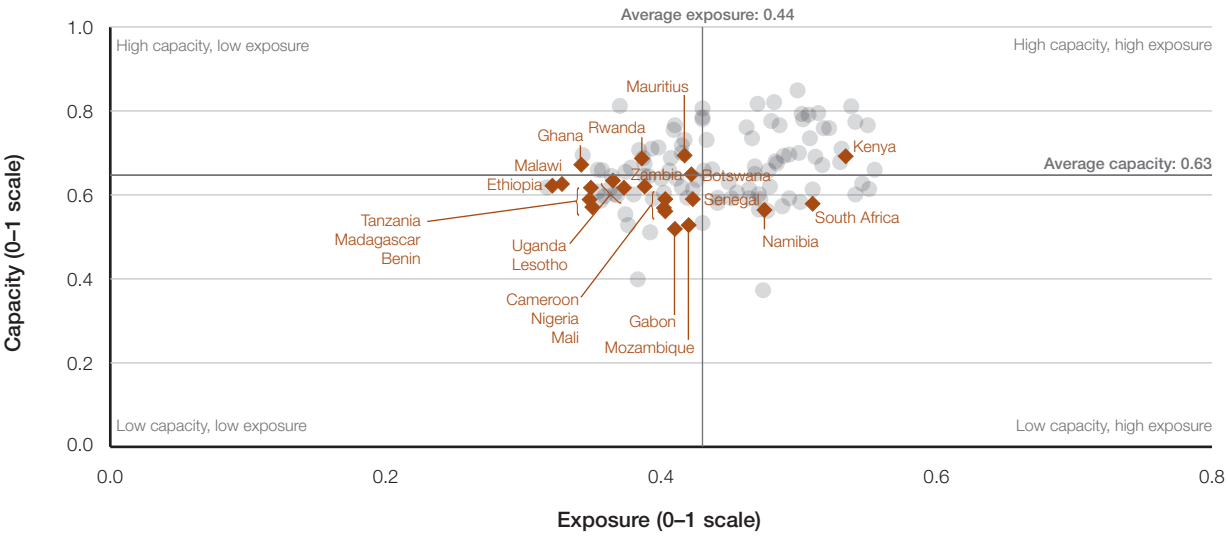


Source: World Economic Forum, Human Capital Index 2016.

The World Economic Forum's analysis also finds that the region's capacity to adapt to the requirements of future jobs—measured by assessing the quality and extent of its education and staff training systems, post-basic education attainment and breadth of skills—relative to the region's exposure to these future trends—measured by assessing the impact of latest technologies, local economic diversification and complexity, employee productivity and unemployment—leave little space for complacency (Figure 3). While a number of African economies are relatively less exposed to technologically-driven labour market disruptions, this picture is changing rapidly. Urgent efforts for closing the continent's skills gap will be needed.

This *Executive Briefing* on the future of jobs and skills in Sub-Saharan Africa is intended as a practical guide for leaders from business, government, civil society and the education sector, including, but not limited to, those participating in the World Economic Forum's *Africa Skills Initiative*. Utilizing the latest available data, including through a research partnership with LinkedIn, it provides a concise overview of the region's emerging opportunities and challenges with regard to shaping the future jobs and skills agenda and concrete recommendations for priority action. It concludes with an overview of – and a call to action to join – the *Africa Skills Initiative* to prepare the region to seize the opportunities of future jobs and skills demand.

Figure 3: Africa's capacity to adapt and exposure to the future of jobs



Source: World Economic Forum analysis.

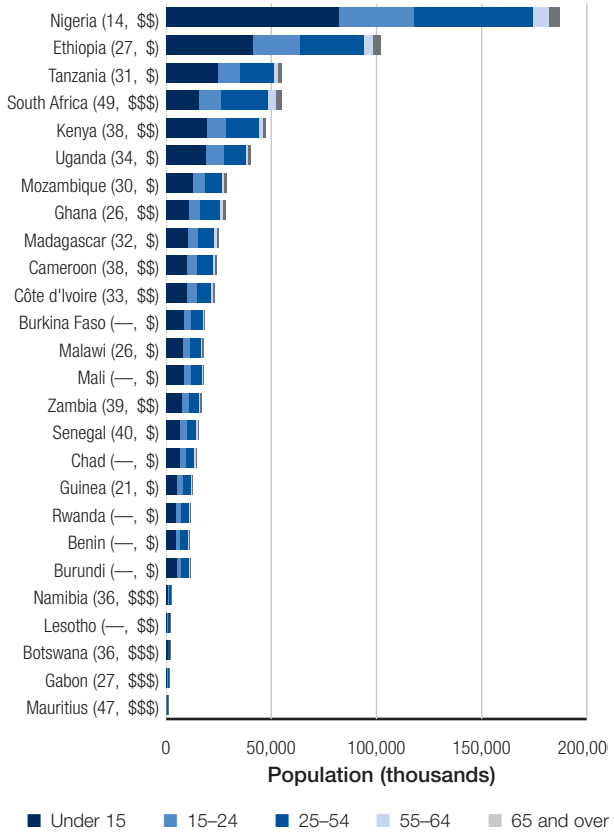
Labour market overview

In recent years, Sub-Saharan Africa has recorded rapid economic growth. Six of the ten fastest-growing economies in the world over the last decade are from the region, which is set to double the size of its economy by 2030 if these trends continue.[4] Income levels and the complexity of local economic activity have been increasing concurrently, from a comparatively low base, including among many of Africa's most populous countries such as Nigeria, Ethiopia, South Africa, Tanzania, Kenya and Uganda (Figure 4). South Africa, Mauritius, Senegal and Kenya are the regions' economies with the highest degree of diversification and complexity.

Labour force participation in the region is high and characterized by the generally strong economic participation of women. However, more significant workforce participation gender gaps remain in countries such as Mauritius, Mali, Côte d'Ivoire and Nigeria (Figure 5).

While the region's rapid economic growth, dynamic young population and high labour force participation hold much promise, challenges remain when it comes to the creation of quality, formal sector jobs. On average, Sub-Saharan Africa exhibits a high-skilled employment share of just 6%, a contrast to the global average of 24%. Some of the most common types of high-skilled employment on the continent include business analysts, school teachers

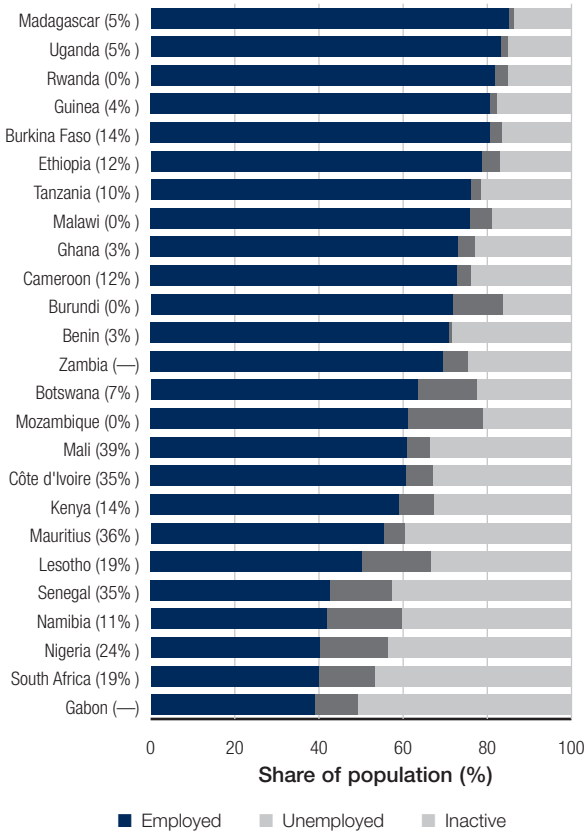
Figure 4: Africa's demographic and economic structure



Source: World Economic Forum, Human Capital Index 2016.

Note: Information in parenthesis after country names refers to economic complexity score and income level. Economic complexity score is calculated on a scale of 0 (least complex) to 100 (most complex); income level is based on World Bank 2016 figures on a scale from $ (low income) to $$$$ (high income). For example, Nigeria has an economic complexity score of 14 out of 100 and an income level of $$ (lower-middle income).

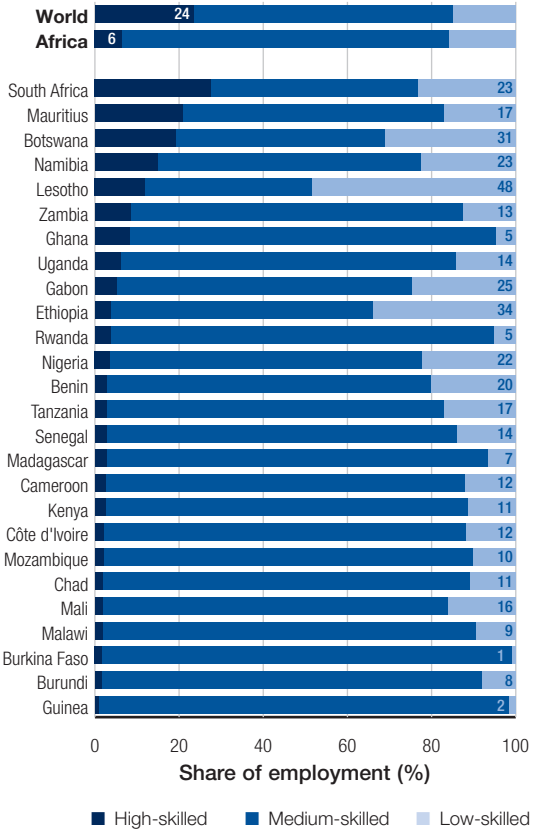
Figure 5: Economic activity, unemployment and inactivity among Africa's working-age population



Source: World Economic Forum, Human Capital Index 2016.

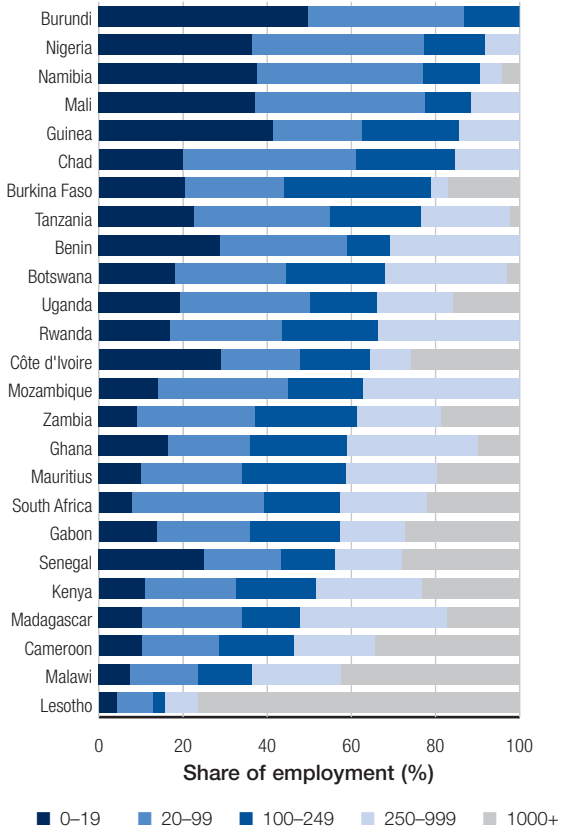
Note: Percentages in parenthesis after country names refer to the labour force participation gender gap. For example, Madagascar has a 5% gap in women's labour force participation.

Figure 6: Africa's employment distribution by skill level required



Source: World Economic Forum, Human Capital Index 2016.

Figure 7: Africa's employment distribution by firm size

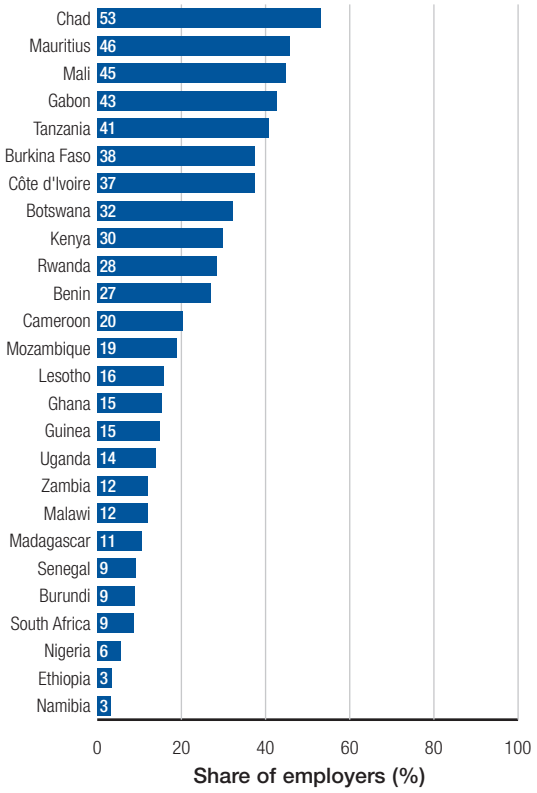


Source: World Bank Database.

and academics, commercial bankers, accountants, human resources, marketing and operations specialists, customer service specialists, advertising professionals, information technology workers and software and app developers, according to LinkedIn's data. Countries such as South Africa, Mauritius and Botswana lead the way in the local availability of high-skilled jobs while others, such as Ethiopia and Nigeria, maintain large proportions of workers in lower-skilled jobs (Figure 6). Formal sector unemployment rates are often high—including among recent secondary school and university graduates—in countries as diverse as South Africa, Nigeria, Mozambique and Senegal (Figure 5). While formal sector employment did grow in Sub-Saharan Africa over the past two decades, this job growth has simply not kept pace with population growth, resulting in fewer opportunities in the formal labour market for the increasing numbers of Africa's young school and university graduates.

Where Africans are employed in the formal sector, this employment tends to be in smaller-sized firms with limited resources to invest in upskilling and reskilling opportunities (Figure 7). In addition, a sizeable number of Africans continue to work in the informal economy,

Figure 8: Share of African employers perceiving inadequate workforce skills as major constraint



Source: World Bank Enterprise Surveys.

on family farms and in urban self-employment – usually sectors where the skills of the newly secondary or tertiary educated are least value-adding and, particularly in rural areas, where they often least aspire to work.[5] This limited success in capitalizing on its existing education investment to date goes to the heart of the region's relatively poor performance on the Forum's Human Capital Index (Figure 2).

At the same time, large numbers of African employers are citing inadequately skilled workforces as a major constraint to business expansion (Figure 8). This points to a double bind. In addition to the mismatch between the number of educated young people seeking jobs and the availability of formal, high-quality jobs, there is the added constraint of young people being inadequately prepared for such roles. Closer dialogue between education providers and industry is needed to align and optimize the region's demand and supply of skills.[6] Additionally, the continent's employers and educators need better tools to enable them to better understand labour markets' new and emerging skills requirements.

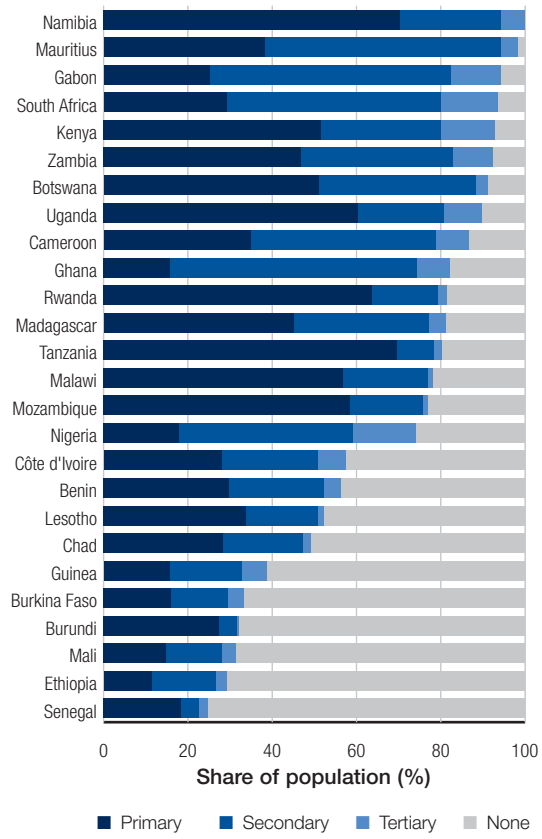
Closing Africa's data gap to close its skills gap

Reliable and timely data on the structure of employment and skills in Sub-Saharan Africa is difficult to obtain. There is scarce information on the number of existing jobs, of newly created jobs, and of unfilled vacancies in specific sectors, undermining efforts to systematically assess and develop the continent's skills base.[7] To produce this *Executive Briefing*, a wide range of traditional and innovative data sources were consulted to provide the most complete picture possible. Nevertheless, initiatives aimed at closing skills gaps can only be so effective if they are hampered by parallel data gaps. To maximize opportunities to build future skills, initiatives aimed directly at improving data collection—including on work in the region's informal sector[8]—are also needed. This need not mean simply copying methods used in other countries.[9] Instead, African governments, with the help of private sector stakeholders, have an opportunity to develop tailored approaches to understanding the region's evolving skills base and emerging jobs scenarios. Limited data also hinders deeper understanding of gender gaps across the region, as many African economies lack data on progression of women across higher-skilled and senior roles, making it hard to gain a more nuanced understanding of both halves of the region's talent.

Education and skills across generations

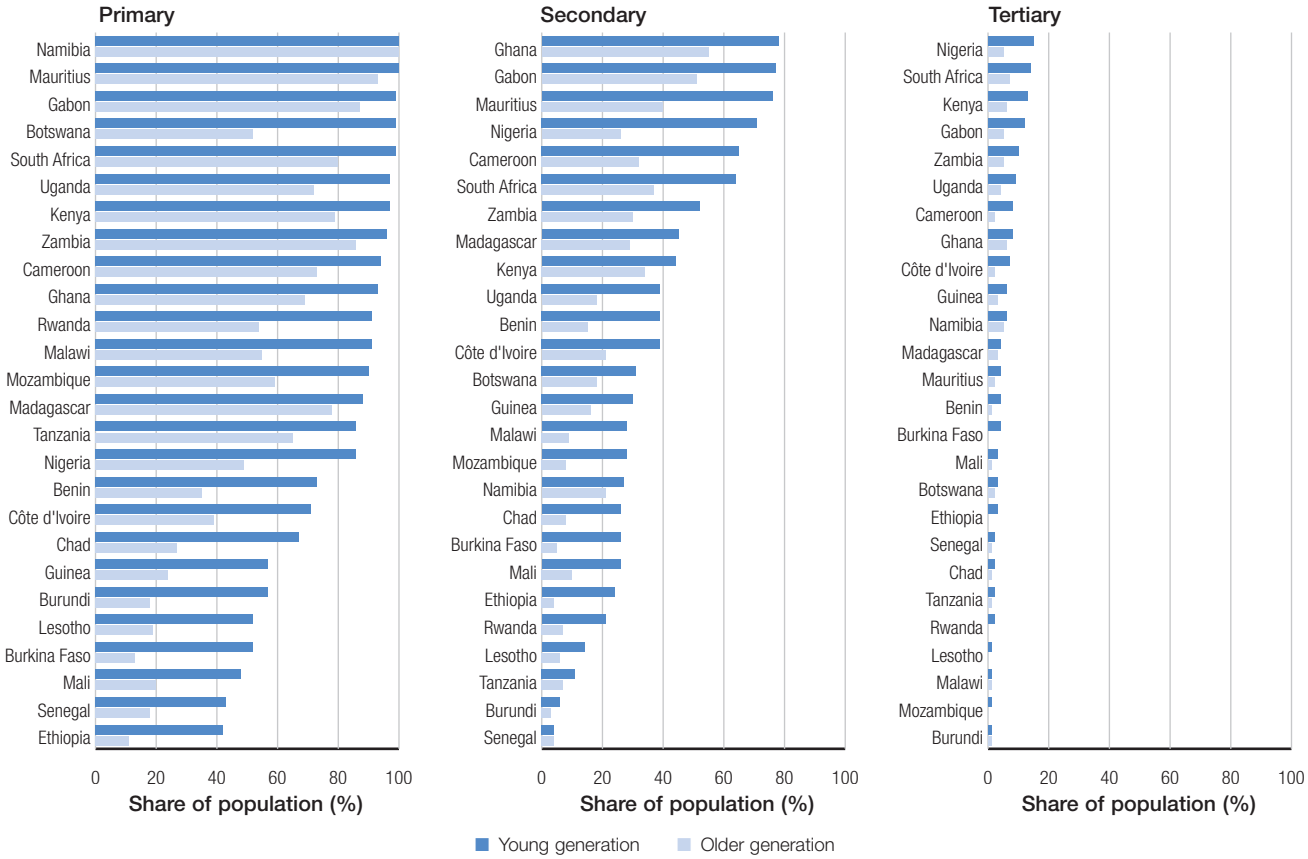
Sub-Saharan Africa has among the lowest number of years of formal education amid its older generations, although this data does not account for alternative modes of learning such as informal apprenticeships, learning on the job and traditional knowledge systems that have provided learning and training opportunities for millions of working-age Africans with little formal, curriculum-based qualifications (Figure 9).[10] In younger cohorts, extensive investment in education has vastly improved the composition of education and skills in the region. As documented in the African Union's recently adopted *Continental Education Strategy for Africa 2016–2025*, the overall pyramid of African education as it stands shows a fairly broad base, at 79% adjusted net enrolment in primary school (up from 59% little more than a decade ago) – equivalent to 144 million African school-age children now accessing primary education. However, enrolment at secondary level drops to 50% and only 7% of young people are enrolled in tertiary education.[11]

Figure 9: Formal qualifications held by Africa's core working-age (25–54) population



Source: World Economic Forum, Human Capital Index 2016.

Figure 10: Educational achievement of Africa's young and older generations

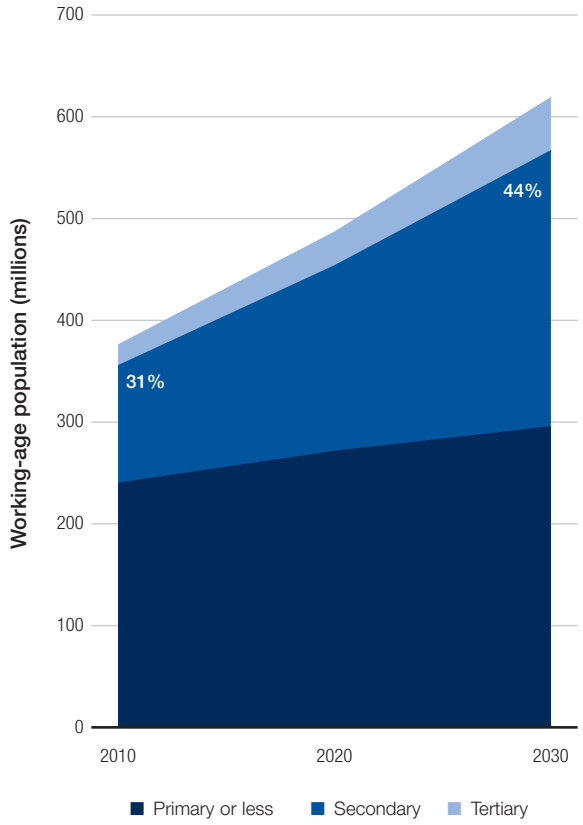


Source: World Economic Forum, Human Capital Index 2016.

Overall, Sub-Saharan Africa's younger generations are considerably more educated—with much higher productive employment potential—than their predecessors (Figure 10). In countries such as Nigeria, Botswana, Benin, Uganda, Malawi and Mozambique the contrast in the education levels of older and younger generations is particularly striking. The combined effects of rising post-basic education attainment and the large proportion of young people across the region present Sub-Saharan Africa with a unique demographic opportunity. If current demographic and education trends continue, the continent's working-age population is set to increase by two-thirds by 2030, from 370 million adults in 2010 to over 600 million in 2030, while the share of this population with at least a secondary education is set to increase from 36% in 2010 to 52% in 2030 (Figure 11).

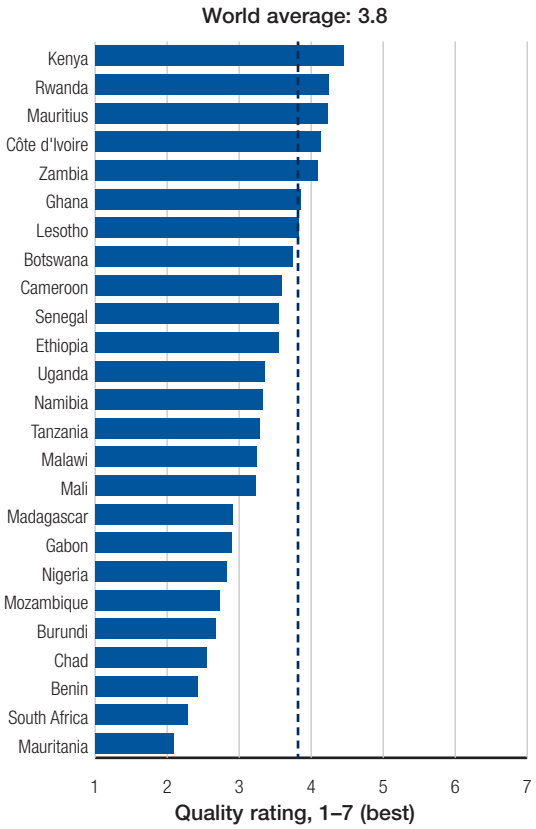
This progress, while setting up more people than ever before for building their future livelihoods, still leaves a very significant portion of the population behind on education, a deficit that will last for decades across multiple generations. The overall expansion in education also masks disparities and uneven outcomes across various segments of the education system. There is currently a lack of upstream and downstream coordination between Africa's primary, secondary and tertiary education providers and the region's pre-primary, technical and vocational, adult training and non-formal education systems remain unevenly developed. In addition, Sub-Saharan Africa retains the largest gender gap in the education of girls and boys of any world region, limiting the breadth of Sub-Saharan Africa's available talent pool and furthering social and economic disparities between women and men later in life.[12]

Figure 11: Projection of Africa's working-age population by level of qualification, 2010–2030



Source: Lutz et al., IIASA/VID Educational Attainment Model, GET Projection, Wittgenstein Centre for Demography and Global Human Capital.

Figure 12: Quality of Africa's education systems

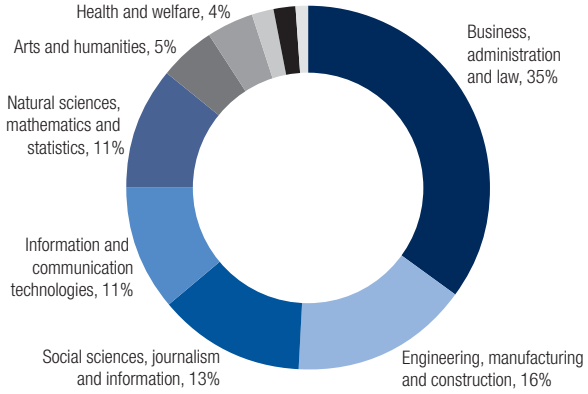


Source: World Economic Forum, Executive Opinion Survey.

For those who are enrolled in schools and universities, African education systems' quality and ability to meet the needs of a competitive economy, as perceived by respondents to the World Economic Forum's *Executive Opinion Survey*, remain a concern. They rank significantly below the global average—suggesting that learners are not acquiring the knowledge and skills required for today's economies and societies (Figure 12). This is further corroborated by business leaders' concerns about the difficulty of finding skilled workers for their businesses.

Finally, for those who are a part of the continent's high-skilled white collar workforce (Figure 13), the data reveals that 35% of LinkedIn's tertiary-educated African members hold Business, Administration and Law degrees—dominated by specialization in accounting and complemented by qualifications in law, business management, banking, finance, marketing and human resources. The data also suggests the availability of a fairly large science, technology, engineering and mathematics (STEM) and information and communication technology (ICT) talent pool, comprising nearly 40% of the LinkedIn sample and split between specialization in Engineering, Manufacturing and Construction (16%), Information and Communication Technologies (11%), and Natural Sciences, Mathematics and Statistics (11%). Within Engineering, Manufacturing and Construction, more than half of graduates have focused on electrical, civil, mechanical or chemical engineering, or architecture and urban design. Among those with an ICT qualification, the large majority are specialized in either computer science or in developing and maintaining information systems and databases. A much smaller cohort of African professionals have studied hardware and software engineering and only a select few have focused on artificial intelligence. Among those who have specialised in Natural Sciences, Mathematics and Statistics, more than half have studied basic sciences such as biology, chemistry or mathematics, while more than one in six have focused on applied fields such as biochemistry, bioinformatics, neuroscience or environmental science.

Figure 13: Distribution of fields of study among Africa's tertiary-educated workforce



Source: LinkedIn.

The future of jobs

An estimated 15 to 20 million increasingly well-educated young people are expected to join the African workforce every year for the next three decades. Delivering the quality jobs to match in order to fully leverage the continent's demographic opportunity is set to be one of Sub-Saharan Africa's defining challenges over the coming years. Simultaneously, the Fourth Industrial Revolution will interact with a range of additional socio-economic and demographic factors affecting the region, resulting in major disruptions to labour markets, growth in wholly new occupations, new ways of organizing and coordinating work, new skills requirements in all jobs and new tools to augment workers' capabilities (Figure 14).

Sub-Saharan Africa stands at a crossroads regarding its future development path, with a range of opportunities to invest in its skills base, leveraging existing strengths to increase local value-add across a broad range of industries. Investment in specialist skills and local talent in the building and construction trades due to rapid urbanization and a continent-wide need for infrastructure development is one obvious example. Additional demand for specialist skills and local talent in consumer industries such as agriculture, food and beverages, home and personal care, apparel and transport and automotive, expanding rapidly due to the region's growing population, is another.[13] As the Fourth Industrial Revolution unfolds, Sub-Saharan Africa is also poised to develop new business models on the basis of these technologies.[14] Innovations such as mobile payments systems like M-Pesa in financial services, the use of drones for last mile delivery in transportation and logistics and the development of a wide range of digital applications tailored to Africa's continued importance and unique strengths in agriculture point to the growth of these new aspects in the region's economy.[15]

What is likely to be the jobs impact of these changes?

Much as in more economically advanced world regions, concerns have recently been raised regarding the potential impact of automation on jobs on the continent. It has been estimated that, from a technological standpoint, 41% of all work activities in South Africa are susceptible to automation, as are 44% in Ethiopia, 46% in Nigeria, 48% in Mauritius, 52% in Kenya and 53% in Angola.[16] However, these effects are likely to be moderated by comparatively lower wages and slower technology adoption.

In addition, whether jobs are declining, stable or growing, they are going through major changes to their skills profile. The World Economic Forum's Future of Jobs analysis found that, just in South Africa alone, 39% of core skills required across all occupations will be different by 2020 as compared to what was needed to perform those roles in 2015.[17]

At the same time, across the continent, substantial potential exists for creating high value-adding formal sector jobs in a number of areas.

While the Fourth Industrial Revolution may be disruptive to many occupations, it is also projected to create a wide range of new jobs in fields such as STEM, data analysis, computer science and engineering. There will be strong demand for professionals who can blend digital and STEM skills with traditional subject expertise, such as digital-mechanical engineers and business operations data analysts, who combine deep knowledge of their industry with the latest analytical tools to quickly adapt business strategies. There will also be more demand for user interface experts, who can facilitate seamless human-machine interaction.[18] For Sub-Saharan Africa, the greatest long-term benefits of such jobs are likely to be found in the promotion of home-grown African digital creators, designers and makers, not just digital deliverers.[19]

Figure 14: Drivers of Change, 2015–2020

Drivers of change, 2015–2020	Rank
Processing power, Big Data	1
Changing nature of work, flexible work	2
Middle class in emerging markets	3
Mobile Internet, cloud technology	4
Geopolitical volatility	5
Climate change, natural resources	6
Sharing economy, crowdsourcing	7
New energy supplies and technologies	8
Young demographics in emerging markets	9
Rapid urbanisation	10
Women's economic power, aspirations	11
Internet of Things	12
Adv. Manufacturing, 3D printing	13
Artificial Intelligence	14
Robotics, autonomous transport	15
Adv. materials, biotechnology	16

Source: World Economic Forum, The Future of Jobs Survey.
Note: Survey based on South Africa only.

However, future job growth will not be limited to the technology sector alone. Investment in Sub-Saharan Africa's enormous infrastructure needs, such as improvements in the continent's transport networks, is booming. While the potential benefits of such "hard" infrastructure investments are well-recognized, economists predict equivalent or greater – often untapped – job creation potential of investments in countries' "soft" infrastructure of childcare, eldercare and education, which also often produce more gender-balanced labour market outcomes. For example, the direct and indirect job creation effects of an investment of 2% of GDP in South Africa would amount to 511,000 jobs in construction (with 29.6% of direct jobs going to women) and 414,000 jobs in care (with 61.4% of direct jobs going to women).[20] Investing in the care economy also dovetails with the recognized importance of early-childhood education for human capital development. In addition, millions of new teachers will also be needed across the continent.[21]

The transition to a more ecologically sustainable economic model also has the potential to create millions of new jobs globally, including in Sub-Saharan Africa. For example, it is estimated that by 2025 South Africa alone could create 462,000 additional jobs by "going green", including in clean energy generation, energy efficiency, pollution control and natural resource management. Similar estimates exist for countries such as Mauritius, Namibia, Kenya, Senegal, Uganda and Zambia.[22]

Finally, regardless of sector or occupation, new work formats are offering individuals and entrepreneurs new opportunities. Online platform work is on the rise globally, including in Sub-Saharan Africa. For example, the continent currently has 56 e-ridesharing services, most of them homegrown apps launched over the last three years.[23] In Africa, online talent platforms have the potential to create significant benefits by moving people from informal to formal jobs, by increasing workforce participation and hours worked of those formerly underemployed or inactive, by shortening the duration of job searches and by enabling matches that would otherwise not have happened.[24] By 2025, this could result in 536,000 additional full-time equivalent jobs and a US$3bn increase in GDP in Kenya, 861,000 jobs and US$20bn in South Africa, and 1.9 million jobs and US$20bn additional GDP in Nigeria.[25] As elsewhere, African companies will increasingly need to learn to manage a distributed, virtual workforce, to integrate virtual freelance workers and to mitigate the challenges engaging in online work.

Future-ready strategies

The current spread of education and skills across generations and the expected future trajectory of jobs point to particular strategies for the region to ensure that it is prepared for the labour markets of the future.

Recent World Economic Forum research on *Realizing Human Potential in the Fourth Industrial Revolution*, developed through in-depth consultation with leading experts and practitioners, recommends a number of levers for creating stronger education systems, including: 1) expanded access to early-childhood education; 2) ensuring the 'future-readiness' of curricula; 3) investing in developing and maintaining a professionalized teaching workforce; 4) early exposure to the workplace and career guidance; 5) investing in digital fluency and ICT literacy skills; 6) providing robust and respected technical and vocational education and training (TVET); 7) creating a culture of lifelong learning; and 8) openness to education innovation.[26]

All eight areas apply to the region and it must ensure that access is universal, leadership of reforms is drawn from multiple sectors and that new education systems are designed for the long-term, while maintain agility to cope with the constant pace of change.

This section highlights four particular areas for strategic focus: ensuring the 'future-readiness' of curricula, especially through a focus on STEM fields; investing in digital fluency and ICT literacy skills; providing robust and respected technical and vocational education and training (TVET); and creating a culture of lifelong learning including the provision of adult training and upskilling infrastructure.

Providing robust and respected technical and vocational education and training (TVET)

Currently, economies across Sub-Saharan Africa have not fully leveraged the opportunities offered by TVET, with formal enrolment standing at only 6% of total secondary and post-secondary enrolment across the region.[27] In parallel to improving the job-relevance of formal TVET instruction, support should also be given to upgrading Africa's more widespread practice of offering informal apprenticeships.[28] However, the latter may often present fewer opportunities to update curricula with new practices through strategic corporate initiatives and a balance must be found between formal and informal approaches.[29]

Creating a culture of lifelong learning

While the bulk of Africa's population is very young, for those cohorts that are already part of the workforce, there is a need for both a culture of lifelong learning as well as the infrastructure that can help make such continued learning and training feasible. This is particularly necessary due to the rapid technological developments taking place in the global labour market and Sub-Saharan Africa's uneven provision of formal education to date. The continent will particularly benefit from the provision of lifelong learning opportunities that provide support for reskilling and upskilling and a shift towards a more holistic approach for encouraging and recognizing skills acquisition across all types of training. More learning will need to take place in the workplace and greater private sector involvement holds the key to building more resilient talent pools in the region. Africa's employers should therefore offer learning opportunities to their workers, in collaboration with governments, schools, universities and non-formal education providers. Continental and sub-regional harmonization of curriculum design and skills recognition will make these efforts more efficient and fruitful, for companies and workers alike.

Ensuring the 'future-readiness' of curricula

For an optimistic vision of the future of jobs in Sub-Saharan Africa to become a reality, investment in human capital must aim not just to develop the skills needed today, but also to start building the skills needed to successfully leverage the technological advances of tomorrow. To develop this pipeline of future skills, Africa's educators should begin by encouraging critical thinking, creativity, cognitive flexibility and emotional intelligence, as opposed to rote learning, to match the way people will increasingly work and collaborate in the Fourth Industrial Revolution. A particular strategic focus for the region should entail updating the quality of science, technology, engineering and mathematics education at the secondary level and through technical and vocational and tertiary education to develop a workforce capable of competing in technology-driven economies. Currently, African college graduates with a STEM degree represent a mere two percent of the continent's total university-age population[30] but are increasingly needed across a wide variety of industries. Not everyone needs to become an engineer or a data scientist but, as African employers expect to have many thousands of job openings requiring basic and more advanced STEM literacy, much is to be gained by increasing African workforces' overall future-readiness in this field.[31] As in more advanced economies, special attention should also be given to encouraging female STEM talent, as currently, for example, only 17% of students pursuing degrees in science and technology subjects in Kenya are women, as are 24% in Tanzania, 18% in Uganda and 27% in Rwanda.[32]

Investing in digital fluency and ICT literacy skills

Developing and implementing 'future-proof' basic and vocational curricula includes digital fluency and ICT literacy skills, which it is important to highlight as a particularly high value investment for the future. Emerging jobs around the world and across all skill levels are becoming more intensive in their use of digital technologies, including in Sub-Saharan Africa. According to estimates by the World Bank, the average ICT intensity of jobs in South Africa increased by 26% over the last decade, while 6.7% of all employment in Ghana and 18.4% of all employment in Kenya occurs in occupations with high ICT intensity.[33] In addition, a number of African countries have successfully positioned themselves as hubs for the global digital business process outsourcing (BPO) sector, including Ghana, Mauritius, Kenya, Senegal and South Africa. For example, more than 210,000 South Africans and roughly 7,000 Kenyans currently work in BPO, mostly in voice-based services and transactional back-office services.[34] However, the greatest long-term benefits of ICT intensive jobs would be unlocked by equipping Africans with the skills to design and engineer home-grown solutions rather than simply servicing the lower-skilled delivery end of the global digital market.[35]

Finally, improving labour market data and forecasts is in itself a tool for designing better and more nuanced future-ready strategies, focused on specific skills, geographies or sectors.

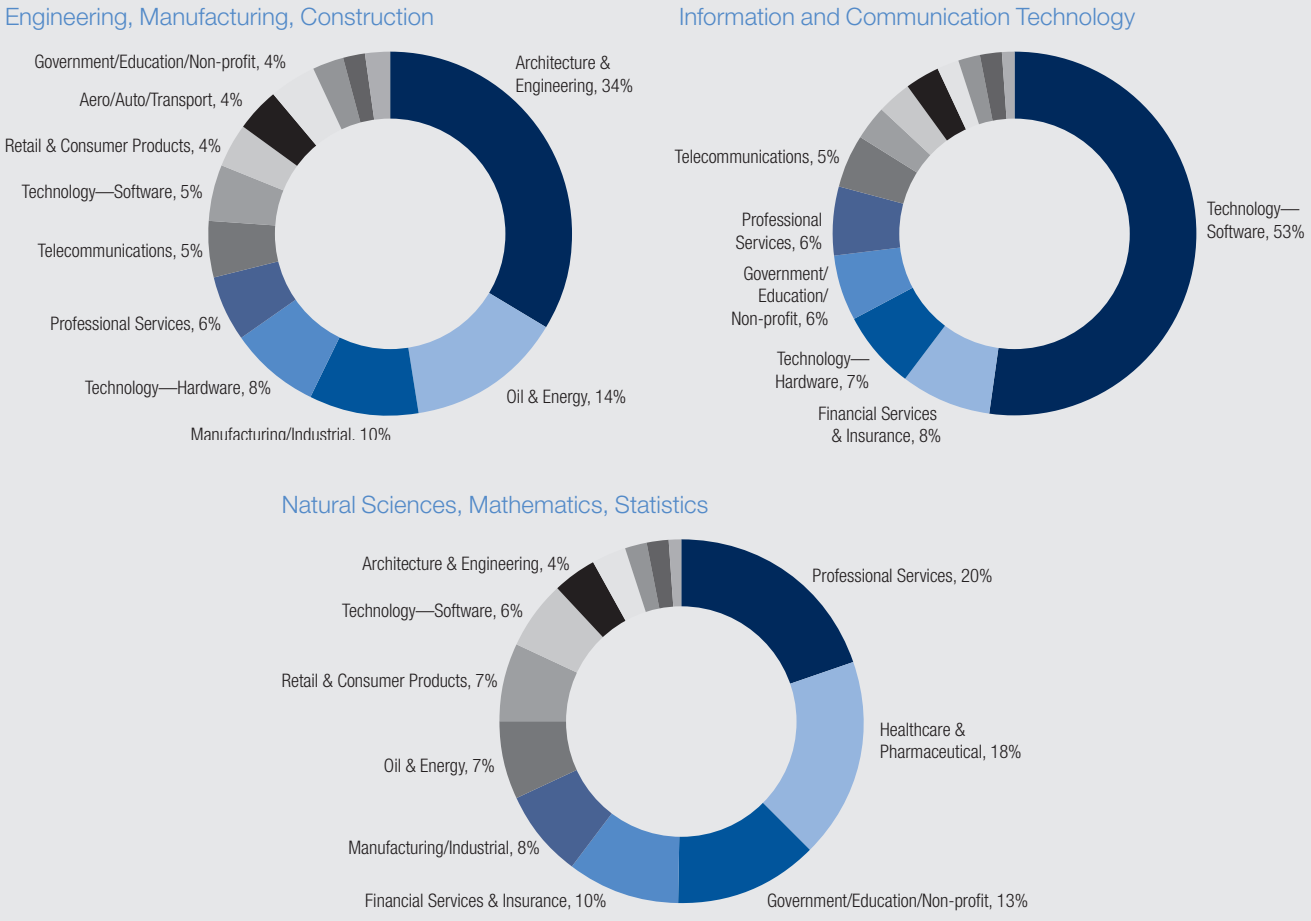
Dynamic data for decision-making

A nuanced view on the current deployment of educational specializations across key industries, rather than assumptions based on past patterns, is critical to understanding the extent to which particular industries and degrees are tied in today's labour market. This is particularly important for identifying and engaging industry stakeholders in the co-development and refurbishing of relevant degree curricula. We provide one such view below through our research partnership with LinkedIn, indicating the pattern of co-occurrence between degrees and industries, which suggests that some fields of study have particularly close relationships to certain industries, while others feed more broadly into Africa's labour market (Figure 15, 16 and 17). For example, despite particular concentrations of Engineering, Manufacturing and Construction specializations in the architecture, engineering and energy sectors and of ICT specializations in the software industry, strong demand for STEM and ICT skills exists across a wide range of Africa's industries (Figure 15).

A second promising approach for policymakers, businesses, educators and workers to understand the unfolding employment landscape consists of tracking the growing and declining share of specific job functions and particular professions on the basis of data from professional networking sites and online job adverts. We provide one such picture for Africa below through our research partnership with LinkedIn, indicating growing shares of job functions broadly in the fields of business development, education, entrepreneurship, media and communications and marketing, among others (Figure 18). Reviewing the detailed matching data for particular professions reveals upward trends in professions such as the creative industries, food technologists, 3D designers, data centre workers and care, education and health workers (Figure 19).

Such data, while limited to those who have digital access and often available for the high- and medium-skilled white collar workforce only, holds strong potential over time for improving forecasts and planning for specific skills, occupations, sectors and geographies.

Figure 15: Employment distribution of Africa's tertiary-educated workforce by degree and industry, broad STEM specialization



Source: LinkedIn.

Figure 16: Employment distribution of Africa's tertiary-educated workforce by degree and industry, overall

Field of Study	All Industries	Aviation, Transport and Automotive	Architecture and Engineering	Financial Services and Insurance	Government, Education, Non-profit	Healthcare and Pharmaceutical	Manufacturing	Media and Entertainment	Oil and Energy	Professional Services	Retail and Consumer Products	Staffing	Technology, Hardware	Technology, Software	Telecommunications
Business, administration and law	35	37	18	68	31	15	30	21	25	45	39	45	11	14	30
Engineering, manufacturing and construction	16	25	58	3	5	6	31	6	44	5	11	4	47	8	28
Social sciences, journalism and information	13	11	5	13	22	5	8	29	7	17	13	14	4	6	10
Information and communication technologies	11	7	3	5	6	3	5	7	5	4	5	5	30	61	18
Natural sciences, mathematics and statistics	11	8	4	6	12	37	17	7	15	11	12	6	5	6	7
Arts and humanities	5	4	6	2	8	2	3	21	2	7	4	6	2	2	3
Health and welfare	4	2	1	1	5	26	2	3	1	5	3	15	1	1	1
Services	2	4	2	0	3	2	1	4	1	3	2	2	0	0	1
Education	2	2	1	1	7	2	1	2	0	1	1	2	1	1	1
Agriculture, forestry, fisheries and veterinary	1	1	1	0	1	2	1	1	1	1	9	0	0	0	1
Unspecified	0	1	1	0	0	1	1	1	0	0	1	1	1	0	0
All	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

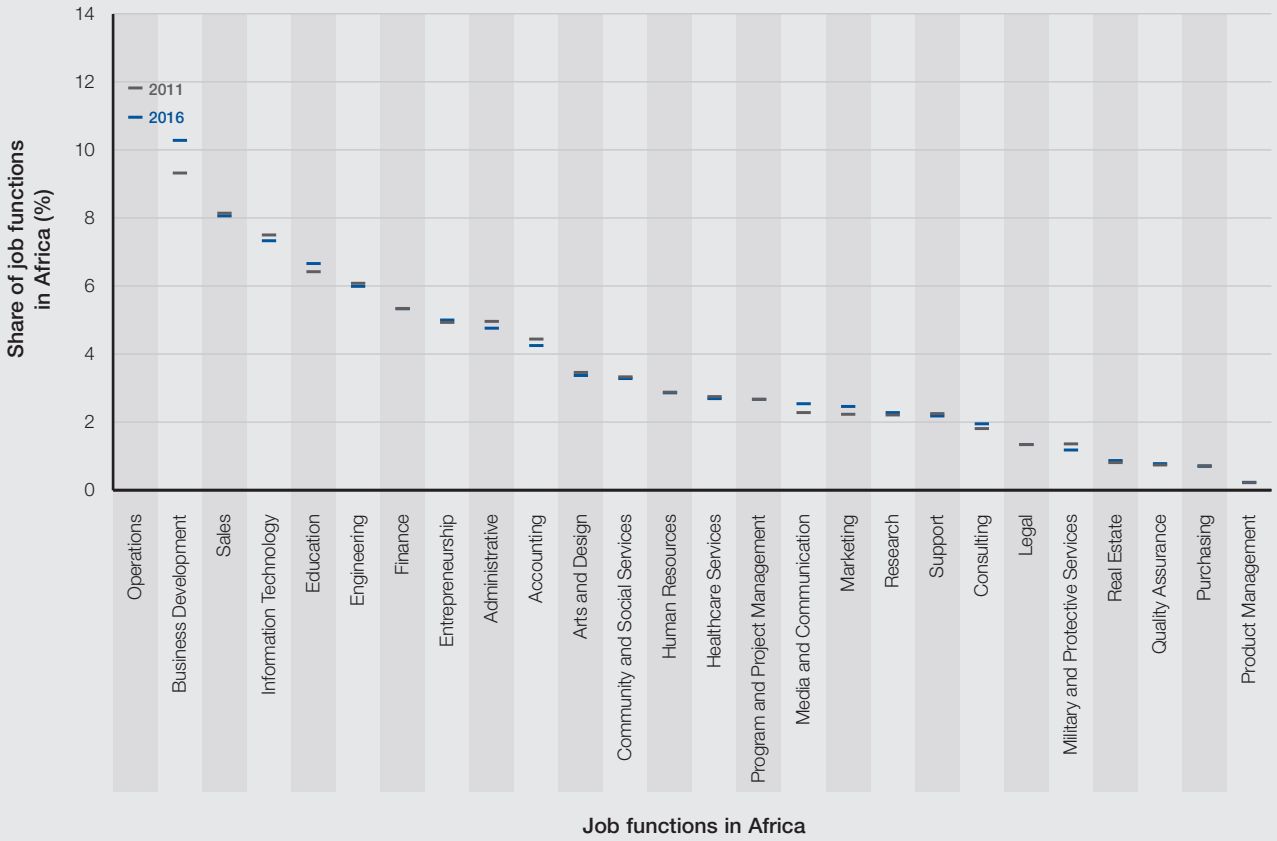
Source: LinkedIn.

Figure 17: Employment distribution of Africa's tertiary-educated workforce by degree and industry, detailed STEM specialization

	INFORMATION AND COMMUNICATION TECHNOLOGY								ENGINEERING, MANUFACTURING AND CONSTRUCTION									NATURAL SCIENCES, MATHS AND STATISTICS	
Industry	computer science	information science and technology	computer engineering	software engineering	computer application	information security	artificial intelligence	interaction design	electrical engineering	electronics	bioengineering	mining engineering	quality assurance engineering	product design	aeronautical engineering	nuclear engineering	safety engineering	biochemistry	bioinformatics
Technology, Software	51	55	41	70	48	66	48	13	10	20	2	1	3	3	5	2	2	4	23
Fin. Service, Insurance	8	9	5	5	8	7	8	0	2	4	2	2	5	2	3	3	0	7	2
Technology, Hardware	8	4	18	3	4	3	3	0	29	14	1	0	3	1	0	4	0	1	0
Professional Services	6	6	5	5	9	5	12	13	4	5	15	3	10	12	3	22	8	17	35
Gov't, Edu., Non-profit	6	8	4	4	9	9	7	9	3	4	8	2	9	4	4	9	3	11	8
Telecommunications	5	4	10	3	4	3	3	0	12	24	0	1	3	1	0	0	0	2	1
Retail and Consumer	3	3	2	2	4	1	2	0	4	3	8	1	16	6	1	1	3	14	0
Media, Entertainment	3	2	2	2	2	0	1	0	2	4	1	0	1	4	1	1	2	3	0
Architecture, Engineering	3	2	3	2	4	0	7	61	7	3	1	3	8	53	9	14	13	3	1
Oil and Energy	2	2	4	1	1	3	3	0	15	7	1	4	8	2	4	31	64	4	0
Manufacturing	2	2	2	2	4	2	1	4	7	6	2	83	17	7	2	12	2	4	2
Aviation, Transport, Auto	2	2	2	1	1	0	2	0	4	4	1	0	10	3	67	1	2	1	0
Healthcare, Pharma.	1	1	1	1	1	0	1	0	1	1	56	0	8	1	1	0	2	29	30
Staffing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
All	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: LinkedIn.

Figure 18: Trending job functions in Africa, 2011–2016



Source: LinkedIn.

Figure 19: Trending professions in Africa, 2011–2016

Profession	Growth, 2011–2016
Quality Assurance Testers	24%
Entrepreneurs	20%
Trust Officers	20%
Political and Legislative Managers	20%
Business Managers	16%
Health and Medical Practitioners	14%
Data Centre Managers	14%
3D Designers	14%
Program Analysts	13%
Business and Financial Operators	12%
Care and Personal Services	11%
Food Technologists	11%
Office and Administrative Support	10%
User Experience Designers	9%
Physicists	9%
Education	8%
Creative Industries	7%
Language and Localization Specialists	6%
Mariners	5%
Public Relations Specialists	5%

Source: LinkedIn.

The *Africa Skills Initiative*

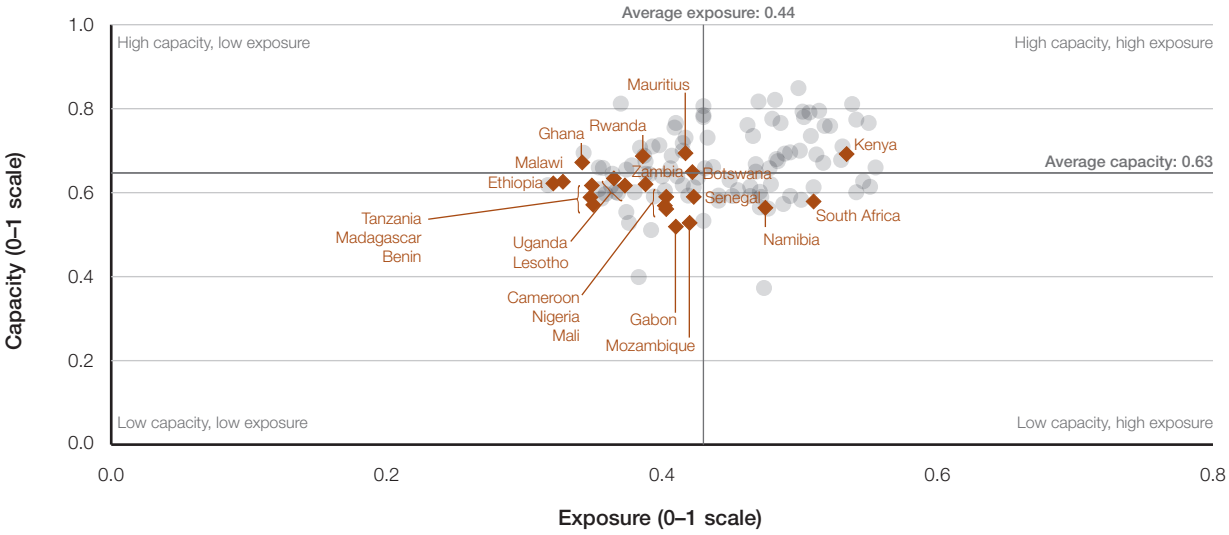
The key challenge for the region entails reshaping countries' skills development agendas in line with their exposure to the jobs landscape of the future. While a large cluster of African countries (the lower left quadrant of Figure 20) currently have a comparatively low capacity to adapt to the requirements of future jobs, their relative exposure to these trends, at least for now, is also still somewhat limited. These economies have a window of opportunity for engaging in long-delayed reforms and their efforts should particularly focus on strengthening basic education as well as building a strong TVET system to lay a good foundation for the future.

A second group of countries—including Kenya and South Africa—have a somewhat higher capacity to adapt but are also more immediately exposed to the job disruptions of the Fourth Industrial Revolution. In these countries, urgent reskilling and upskilling efforts are needed, focusing in particular on strengthening higher education and adult learning.

Finally, a number of African countries, including Ghana, Rwanda and Mauritius, have a relatively high capacity to adapt to the requirements of future jobs and are comparatively well-positioned to prepare themselves, with relatively low exposure at present – but here, too, there is no room for complacency, and efforts to embed a culture of lifelong learning and continuous upskilling are needed.

The region urgently needs to make the right investment decisions today to strengthen the continent's foundations for the jobs and skills of tomorrow. Africa's CEOs cite insufficient understanding of the disruptive changes underway as the single biggest obstacle to future workforce planning, followed by resource constraints and insufficient alignment of firms' talent strategies with their broader innovation strategies.[36] Collaboration between business and the education sector is also limited. In addition there is relatively little collaboration among the firms that are seeking to address skills gaps in their own workforces as well as the communities around them, resulting in uncoordinated, potentially wasteful, efforts.

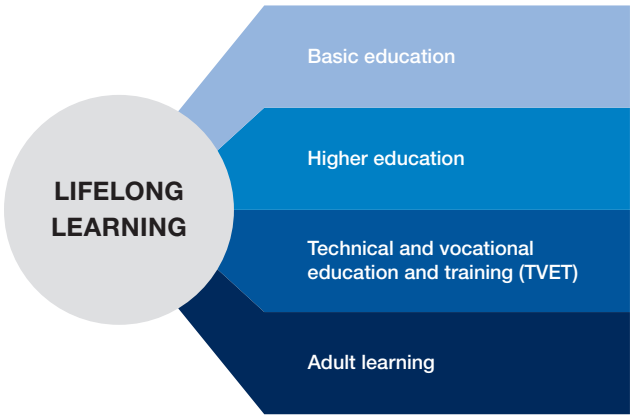
Figure 20: Baseline analysis of country-level priorities for the *Africa Skills Initiative*



Source: World Economic Forum analysis.

The World Economic Forum's *Africa Skills Initiative*, a part of the broader efforts of the Forum's System Initiative on Shaping the Future of Education, Gender and Work, serves as a platform to help change this. It provides relevant new insights, brings together different businesses' efforts to address future-oriented skills development and supports constructive public-private dialogue for urgent and fundamental reform of education systems and labour policies to prepare workforces for the future of jobs (Figure 21). At the World Economic Forum on Africa 2016 in Kigali, Rwanda, members of the Initiative agreed to particularly focus on the STEM and ICT skills that are critical to the continent's future development.[37] The Initiative is championed by the Forum's Africa Regional Business Council and supported by a large number of other constituents. We invite others to join these efforts.

Figure 21: Target areas of the *Africa Skills Initiative*



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