

HUMAN CAPITAL AND PRODUCTIVE EMPLOYMENT CREATION

ADDRESSING AFRICA'S SKILLS GAP



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Methodological note: Unemployment and the level of education represent key themes in this report. However, because countries follow different approaches in terms of defining and measuring unemployment and education metrics, and also for statistical soundness reasons in many cases, it often proves more useful to utilise a single source for these metrics, especially for comparison, modelling and forecasting purposes. Hence, throughout this report, standardised figures often utilise sources different from those reported by statistical offices. Figures provided by statistical offices or other in-country organisations may well be elaborated on in this report, in which case the sources will be clearly referenced.

FOREWORD

As the Fourth Industrial Revolution (4IR) takes hold and spreads across the globe, all countries and regions will have to adapt to this new economic reality. The 4IR is leading to fundamental changes to economic structures, directly impacting the demand for skills. Trends that will require structural changes in skills include the remote working, digitalization, and efforts to ensure just transition to greener energy.



The most challenging shift pertains to the worldwide impact of the technological changes, such as artificial intelligence, on jobs, with potentially huge replacements of people by machines along the entire skills spectrum. In Africa, where the working age population and its share in total are still rising, policies will need to focus on technology adoption that enhances both productivity and employment opportunities. This will require population that is better educated, healthier, technologically savvy, and ready for the changing world of work. However, the overall gap in human capital between Africa and the rest of the world has widened slightly over the years.

Digitalization that the COVID-19 pandemic has accelerated mean that pre-existing skill shortages and mismatches will be accentuated. An added challenge for Africa is that the required technological changes must also address challenges of climate change. The success of efforts to cope with climate change will thus also depend on closing the skill gaps in this area. The analysis of Africa's skill landscape points to a fragmented system, containing pockets of excellence while more than 30% of population in Africa (excluding North Africa) aged 15+ lacks basic literacy.

The report on "Human Capital and Productive Employment Creation: Addressing Africa's Skills Gap", jointly produced by the ECA and the Oxford Economics, examines Africa's skills gap both from a continent-wide perspective along with more in-depth country case studies, with focus on changing economic structures. The aim is to flag examples of successful interventions that can be replicated.

The key policy challenge in the area of skill development for Africa is to support the new and emerging sectors that can drive inclusive and resilient growth. This is critical for creating decent jobs for Africa's growing population and reaching the aspiration of Agenda 2063. This report, which builds on the Best Practices in Job Creation in Africa (also with Oxford Economics), aims to contribute to addressing this challenge.

Zuzana Schwidrowski
Director
ECA Office for North Africa

About the Economic Commission for Africa

As one of the five regional commissions of the UN Economic and Social Council (ECOSOC), the Economic Commission for Africa (ECA) supports Africa's economic and social development, fosters regional integration and promotes international cooperation in support of regional development through research and technical support to governments.



The value of a well-educated and engaged civil society is widely appreciated. The flip side of that coin is the skills that education imparts on the population. Since the Industrial Revolution we have seen how technological advances have necessitated the development of the skills needed to leverage those technologies, with the outcome being a more productive and prosperous society. Technology has never before evolved at such a rapid rate as we see today, meaning it is more imperative than ever that our leaders should take action to ensure that our people are prepared for the future economic landscape.

This report examines the skills mismatch that we see across the African continent today. Not only does this mismatch curtail economic development, with some sectors unable to take off due to the lack of skilled labour, but the mismatch also runs the risk of producing an unemployable workforce, thus perpetuating Africa's unemployment problem. A key insight of this report is that governments across the continent are in a position to address this issue, not by simply committing more resources towards education, but by taking a critical view of the types of skills each country will need, while at the same time ensuring that the sectors that will absorb those skills are being given room to flourish.

At Oxford Economics Africa we translate our passion for economics into fruitful partnerships with our clients, with the central aim of supporting development in Africa. We firmly believe that this report will contribute to that development by putting upskilling top of mind, and by showing how our leaders can prepare the continent for the future.

Noelani King Conradie
Managing Director
Oxford Economics Africa

About Oxford Economics Africa

Oxford Economics Africa, based in the Western Cape Province of South Africa, is a majority-owned subsidiary of Oxford Economics that specializes in political and macroeconomic research in Africa. OEA investigates and interprets the economic, risk, and political conditions of African countries to caution against pitfalls and guide investors towards opportunities. OEA has a strong reputation for independence and quality and has a highly qualified team of economists, econometricians, quantitative analysts and political analysts, who are all experts in their fields and have decades of experience in covering Africa. Insights are provided within the context of comprehensive knowledge of the African continent, its history, and each country's economic setting.

ACKNOWLEDGEMENTS

This study, entitled “Human Capital and Productive Employment Creation: Addressing Africa’s Skills Gap”, is the second report resulting from the collaboration between the Subregional Office for North Africa of the Economic Commission for Africa (ECA), and NKC African Economics, headquartered in South Africa and part of the Oxford Economics Group. It builds on the first joint report on “Best Practices in Job Creation: Lessons from Africa”, published in 2021.

The research for this report was carried out by Jacques Nel, Head of Macro at Oxford Economics Africa, with coordination provided by Amal Elbeshbishi, Economist in the Employment and Skills for Development Section of the Subregional Office for North Africa of the ECA (ECA SRO-NA). The report was prepared under the guidance of Zuzana Schwidrowski, Director of the ECA SRO-NA.

Appreciation is expressed for comments provided by Soumaya Iraqui-Houssaini (Section Chief), Zoubir Benhamouche (Economist) and Aziz Jaid (Economist) of the Employment and Skills for Development of the ECA SRO-NA.

The publication benefited from the discussions, conclusions and recommendations of the webinar on Human Capital and Productive Employment Creation: Bridging the Skills Gap in Africa, organized by the Subregional Office for North Africa of the Economic Commission for Africa, in Rabat on December 7, 2022.

The Subregional Office for North Africa of the Economic Commission for Africa thanks the panel for participating in the webinar and their ensuing recommendations that served to further inform and refine the findings highlighted in this report.

LIST OF ABBREVIATIONS

ADC	Africa Data Centres
ADF	African Development Fund
AU	African Union
AWS	Amazon Web Services
DECI	Digital Egypt Cubs Initiative
DFC	US International Development Finance Corporation
EU	European Union
EUI	Egypt University of Informatics
ICT	Information & Communications Technology
IFC	International Finance Corporation
ILO	International Labour Organisation
IMF	International Monetary Fund
I4G	Ingressive for Good
KNBS	Kenya National Bureau of Statistics
MCIT	Ministry of Communications and Information Technology
MENA	Middle East and North Africa
PDSA	Practical Data Scientist Academy
UN	United Nations
UNDP	United Nations Development Programme
UNIDO	UN Industrial Development Organisation
UIS	Unesco Institute for Statistics
WHO	World Health Organisation
WIOCC	West Indian Ocean Cable Company

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EXECUTIVE SUMMARY

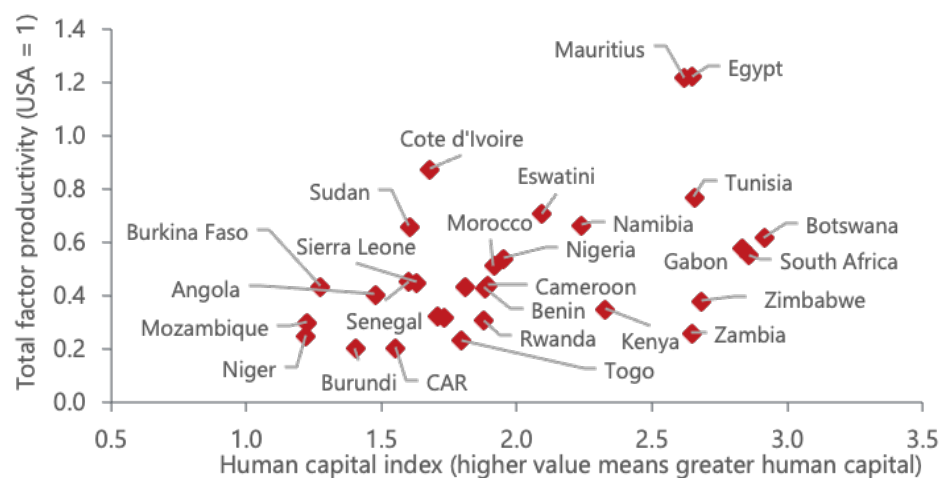
The levels of human capital and skills differ widely between continents and over time. While skills and human capital on the African continent have improved over time, a gap with other continents remains (Penn 2019). Of more concern, the gap in human capital between Africa and the rest of the world has widened slightly over the years. While the fast pace of Asia's human capital growth has contributed to this growing gap, the fact remains that Africa is behind its peers in other continents and the rest of the world.

There is a strong link between a country's human capital and total factor productivity: increasing a country's population's skills capacity also improves the efficiency level of that country's inhabitants. Furthermore, while there is a large gap in the human capital level between Africa and the rest of the world, human capital levels also differ widely within Africa (Penn, 2019). A large cluster of countries has lower levels of human capital and total factor productivity, with a striking geographic or regional divide. Human capital tends to be higher in Southern African and North African countries.

The gap between Africa and the rest of the world has widened slightly over the years

When assessing the dynamics between skills demand and skills supply within an economy, a conundrum regarding causation emerges. Similar to the chicken-or-the-egg archetype, the demand for specific skills is both a product of the size of the sector requiring those skills, as well as a factor in determining the size of the aforementioned sector. The symbiotic relationship between a good supply of skills for a sector that is showing strong growth also has converse implications: the inability to find the necessary skills to develop a sector will hamper the development of that sector, thus reducing the demand for those skills.¹ Furthermore, a country's employment makeup from a sectoral perspective is indicative of the skill demands in those sectors, and the availability of

Human capital and total factor productivity in Africa



Source: Penn World Table, 2019

¹ These mutually re-enforcing externalities have been pointed out by, for example, Snower (1994) for advanced economies and Brixiova (2010) for African countries.

those skills in the economy. The positive externalities associated with skill acquisition provide basis for policy interventions.

This point – that the employment makeup of a country is determined by the structure of an economy and the availability of skills to support that structure – has important implications for economic development and competitiveness.² Importantly, the best way to move to a new equilibrium where the demand for more sophisticated skills by firms matches the supply of those skills among workers will require investment in both human capital and infrastructure (both hard and soft, such as regulation), by both the public and private sectors. Investment in education and the modernisation of education provision need to be accompanied by incentives and the necessary infrastructure to get industries of the future off the ground and on a sustainable footing.

A more productive and educated labour force can act as a catalyst for economic sophistication, but the foundation for these sectors to develop needs to be in place for this virtuous chain reaction to be set off. As the Fourth Industrial Revolution (4IR) takes hold and spreads across the globe, all countries will have to adapt to a new economic reality. This new reality will take the form of fundamental changes to economic structures, and the emergence of new economic sectors at the expense of some traditional sectors. This will of course have a direct bearing on the demand for skills as modern sectors will require modern skills. Major trends that will require structural changes include the global transition towards greener energy, the proliferation of remote working, increasing demand for digital infrastructure, and the broader impact of climate change (and the related efforts to contain it).

The first point of order in bridging the continent's skills gap should be to ensure that the lack of information does not represent an obstacle. This refers to information regarding employment opportunities – making it easier to connect employer and employee – as well as information regarding the type of skills required. The former can be pursued by ensuring that the population has the means to leverage online platforms that match jobseekers with vacancies. In turn, clarity on the skills required necessitates a well-defined strategy and closer collaboration between government, industry bodies, and institutions tasked with formulating and implementing the education curricula. Tertiary institutions together with technical & vocational training centres should have clear communication channels with government and private enterprises in strategic sectors to ensure that education and training evolve with the respective industries' needs. State-sponsored internship programmes will also ensure that individuals can acquire practical experience once the education programme/training is complete. These could potentially be funded through tax incentives to temporarily subsidise employment costs. Importantly, the identification of strategic sectors and efforts to develop these sectors should be aligned with government's broader development agenda. While government creates the infrastructure to ensure that a steady stream of sufficiently qualified individuals enters the labour market – particularly in critical sectors where skills shortages exist – it also needs to establish the policy framework to support the development of these critical

A more productive and educated labour force can act as a catalyst for deeper economic sophistication

² As the World Economic Forum, we define competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country.

sectors. Crucially, it should be noted that labour market outcomes should not be seen as a product of labour market policies alone, but rather as a positive offshoot of the broader policy environment. Accordingly, policies favouring the creation of new businesses, particularly in strategic sectors, should be a top priority. This could require amendments to business regulations and fiscal policy while also necessitating the provision of hard and soft infrastructure.

INTRODUCTION

Skills and education levels of the population impact the quality of jobs generated in a country or region and should thus be a key consideration in broader employment creation initiatives. Given their link with productivity, skills and education are particularly relevant in the African context, which is characterised by low levels of productive employment, especially among the youth. According to the World Economic Forum, on average in Africa (excluding North Africa) high-skilled employment accounts for only 6% of the total employment, in contrast to the global average of 24%. A large share of Africans works in the informal sector. At the same time, firms across the continent emphasise the inadequately skilled workforce as a major constraint to their activities, pointing to long-standing skill shortages and mismatches.

Several mega-trends, especially technological progress and digitalisation, as well as climate change, demographic changes, along the changes in values and preferences that accompany them, impact the current and the future nature of work and demand for skills on the continent. The following comprehensive skills set will be essential for populations in Africa and elsewhere to succeed in the rapidly changing regional and global environment: (i) cognitive, (ii) socio-emotional, (iii) technical, and (iv) digital. With rapid technological progress, digital skills are increasingly important for success in the 21st century labour market.

Yet in the 2020s, skills development continues to be a major challenge for the continent. For example, more than 30% of the African population south of the Sahara aged 15+ lacks basic literacy according to World Bank indicators. At the same time, according to a recent International Finance Corporation (IFC) study, about half of the jobs in Africa already require some digital skills. Technological progress and the adoption of digital technologies have the potential to help build skills among workers, including those with low education, hence boosting productivity across sectors and jobs, provided barriers to digital inclusion are addressed (OECD, 2020). To realise this potential, policies should support firms' access to capital, besides workers possessing basic education and foundational skills, including basic digital literacy.

The purpose of this study is to examine the current state of human capital on the continent, in terms of educational attainment and formal skills acquisition, and to ascertain where the shortages and mismatches are in terms of skills demand and skills supply.³ The analysis also includes national case studies where shortages and mismatches have emerged, allowing for a deeper assessment of their drivers. The report and its case studies also assess policies which have been pursued, successfully or not, to address skills shortages.

Firms across the continent emphasise the inadequately skilled workforce as a major constraint to their activities

³ Although human capital includes education, health, and aspects of "social capital," the main focus of this report on education, where human capital is measured in terms of years of education and the return on education.

The structural shifts that the COVID-19 pandemic and the Russia-Ukraine crisis have accelerated mean that several key skills shortages and mismatches will be accentuated. Identifying these shortages and mismatches and finding appropriate ways to address them represent key factors governments will need to be especially mindful of when developing policies for inclusive and resilient recovery. In addition, the migration of skilled individuals and the implications of freer movement of people under the African Continental Free Trade Area will have to be incorporated into a strategy that aims to address skills shortages and mismatches and generate job-rich growth.

Looking at the current state of human capital through the lens of changing economic structures and increasing occurrence of multiple and cascading shocks will highlight the most pertinent issues preventing sustainable employment creation. It will also suggest measures that can be put in place to address these issues.

HUMAN CAPITAL IN AFRICA

Human capital refers to the attributes an individual holds that are relevant to economic activity. These attributes usually take the form of knowledge, skills, education, health, elements of social capital and other factors to a specific economic activity. According to human capital theory, investments in human capital improve the productivity of individual workers, with more productive workers then becoming a key driver of economic growth and development.

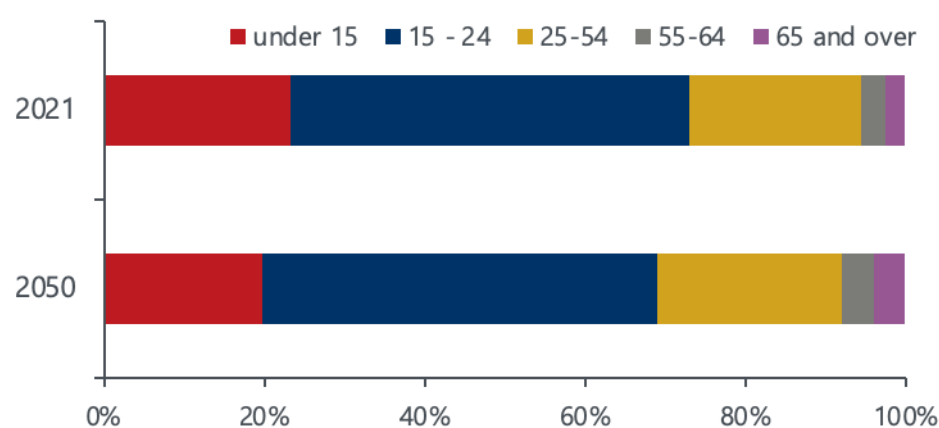
The fourth industrial revolution (4IR) will lead to increased intensity in the use of digital technologies, which will disrupt a wide range of industries and change the nature of employment opportunities (WEF, 2016). Hence, the attainment of different levels of digital skills (from basic to advanced), which would enable the adoption of new technologies and the creation of digital-savvy jobs, will have greater significance in human capital formation in the 4IR. Since the 4IR will be disruptive, with technology replacing workers, it presents a unique challenge to Africa with its rapidly rising, urbanizing, and youthful population seeking jobs (IMF, 2018).

Starting from a relatively low literacy and foundation skills, Africa already lags other regions in the development of human capital and digital skills, presenting a huge task to upskill the continent's population. This will be critical in the context of the 4IR that exacerbates labour market segregation into "low-skill/low-pay" and "high-skill/high-pay" jobs. In this section, we present an overview of how educational attainment and human capital have evolved across the continent over time compared to other regions and the current state of digital skills in Africa.

Driven by the high fertility rates compared with the rest of the world, Africa's working-age population (aged 15-64) is expected to nearly double from 783 million in 2021 to 1.56 billion in 2050 (Haver, 2022). The proportion of the continent's working-age population to its total population will increase from 56.2% in 2021 to 62.6% by 2050,

The demographic opportunity and challenge that will continue to arise in Africa during the 4IR

Africa: Population distribution by age



Sources: Haver Analytics, UN, 2022

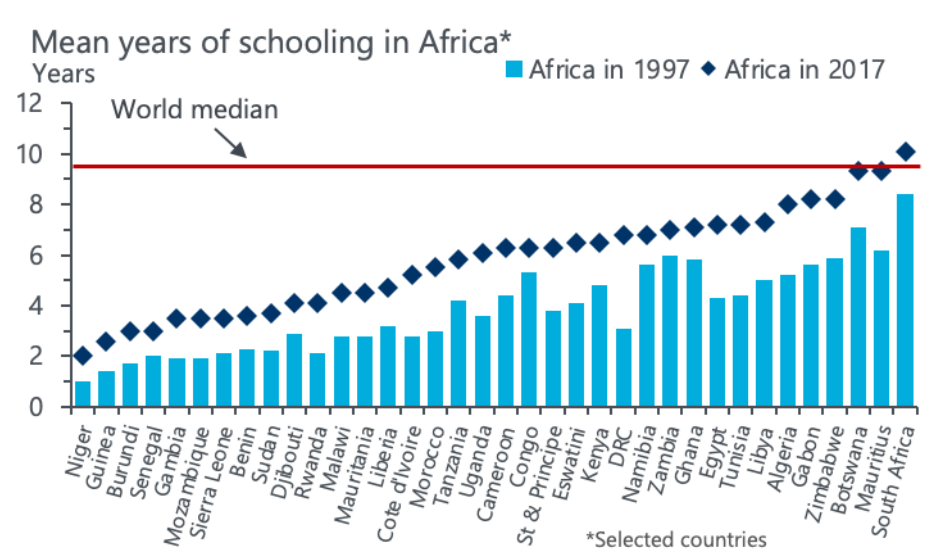
creating an opportunity for demographic dividend. In contrast, the size of the working-age population for the rest of the world is expected to grow by only 4.4% to 4.5 billion over the period, while the share of the working-age population is expected to decrease from 67.0% in 2020 to 63.2% in 2050.

There are also stark differences in the working-age population growth rates between the different regions in Africa. In the Eastern, Western, and Central African regions the working-age populations are forecast to more than double between 2021 and 2050. North Africa is expected to see growth of 50.6% over the period and Southern Africa growth of 30.6%, with the latter regions being already about halfway through the demographic transition.⁴

Africa could potentially squander its demographic dividend due to digital skills gaps

The increase in Africa's working-age population over the next three decades presents both huge opportunities and challenges for improving economic growth and employment on the continent as well as reducing inequality. If productively employed, the rise in the working-age population could drive higher earnings and (therefore) GDP growth, but only to the extent that productive jobs can be created. The job opportunities of the future will require new skill sets, including digital skills, hence Africa could potentially squander its demographic dividend due to skills gaps in critical areas.

The variable 'mean years of schooling' is a key component of the measurement of a country's human capital and is defined as the average number of completed years of education of the population aged over 25. Over the past two decades, the mean years



Sources: UNESCO Institute of Statistics, World Bank

4 Regarding the proportion of the working-age population to the overall population, the Eastern, Western, and Central African regions are expected to see the largest gains between 2021 and 2050. This share should rise from 55.4% in 2021 to 63.8% in 2050 in East Africa, while West Africa is expected to see an increase from 54.1% to 61.9% during the same period. Even though Central Africa should also experience large gains in the relative size of its working-age population, which is expected to rise from 51.7% in 2021 to 59.5% in 2050, this region will continue to lag behind the rest of the continent, remaining below the 60% threshold throughout 2021-50. The Southern and Northern African regions are expected to remain ahead of the pack, remaining in first and second place, respectively, from 2021-50. The working-age population's share in Southern Africa is expected to increase from 64.9% in 2021 to 67.4% in 2050, while North Africa should see a rise from 62.0% to 63.9% during the same period.

EDUCATIONAL ATTAINMENT BY REGION

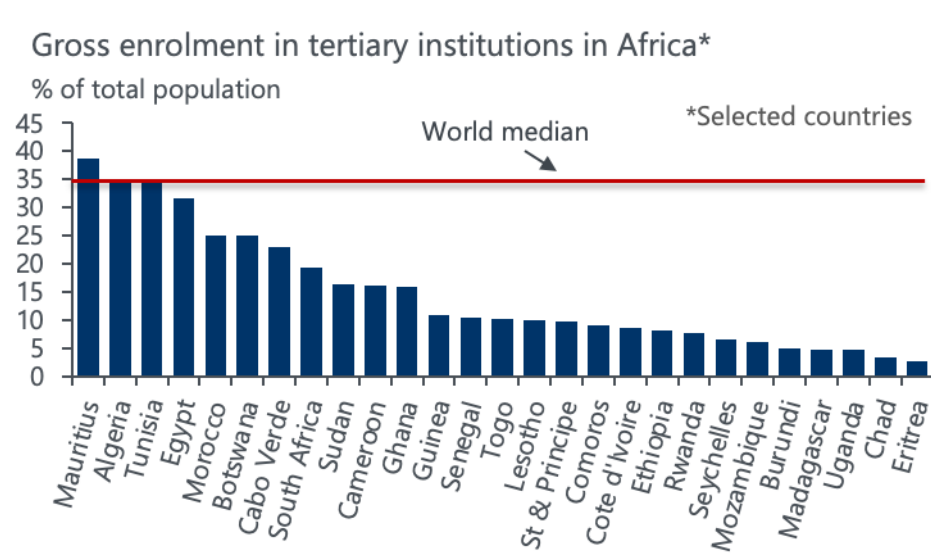
While there is notable variation in the improvement of the level of schooling between the different regions, the relative positions of the regions' education attainment remained the same between 1997 and 2017. Southern Africa retained the first-place position as the region with the highest level of schooling from 1997 to 2017, increasing from 5.3 years to 7.2 years during this period. The 1.9 years increase in the level of schooling is noteworthy as it is above the continental average, despite coming from a higher baseline.

North and Central Africa experienced the largest rise in the average years of schooling during 1997-2017. North Africa saw an increase of 2.5 years to 6.5 between 1997 and 2017 while the average years of schooling in Central Africa rose by 2.3 years to 6.8 during the same period. Interestingly, West and East Africa are the two worst-performing regions, based on their level of schooling, while also experiencing the smallest gains from 1997 to 2017. West Africa's average years of schooling increased by a meagre 1.4 years, from 2.6 in 1997 to 4.0 in 2017. East Africa's average years of schooling rose by 1.7 years, from 3.2 in 1997 to 4.9 in 2017. This highlights the compounding effect of education and the growing inequality between regions and countries. Regions with higher levels of schooling experienced the most gains with regard to educational attainment, while the regions with the lowest level of education are falling more behind as time progresses.

of schooling have improved notably throughout Africa – thanks mainly to a drive to improve the attainment of primary education from a low base. On average, the level of schooling increased by 1.8 years, from 3.9 in 1997 to 5.7 in 2017 (UIS, 2022). Although levels increased across the board, the rankings have remained broadly unchanged with South Africa, Botswana and Mauritius having the highest levels of schooling over the past 20 years.

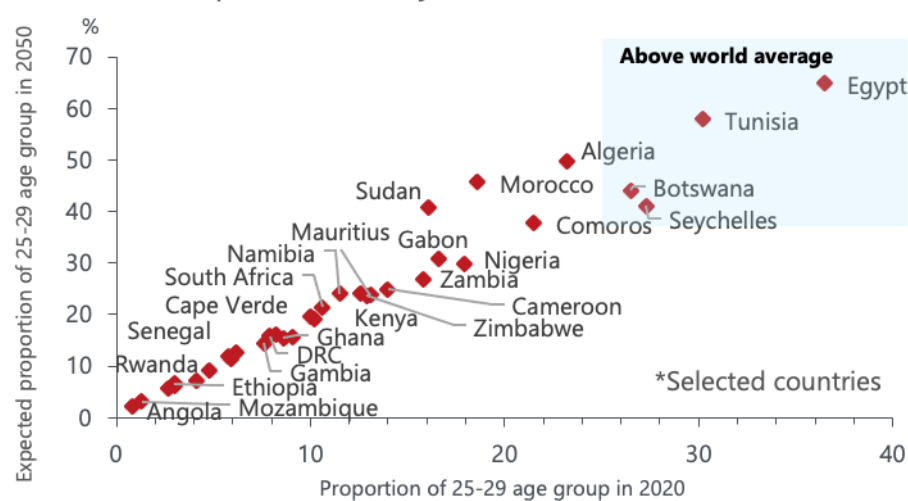
Despite progress in improving access to education, the vast majority of African countries have not caught up to the world median for mean years of schooling which stood at 8.9 years in 2017. This reflects (i) unacceptably large sections of the continent's population, especially in the least-developed countries, that are still deprived of access to primary education and (ii) poor learning outcomes. Advances in improving levels of primary

The gross enrolment of populations at tertiary institutions is lower than in other regions and differs widely across the continent



Sources: UNESCO, World Bank 2020

Attainment of post-secondary education in Africa*



Source: Wittgenstein Centre for Demography and Global Human Capital

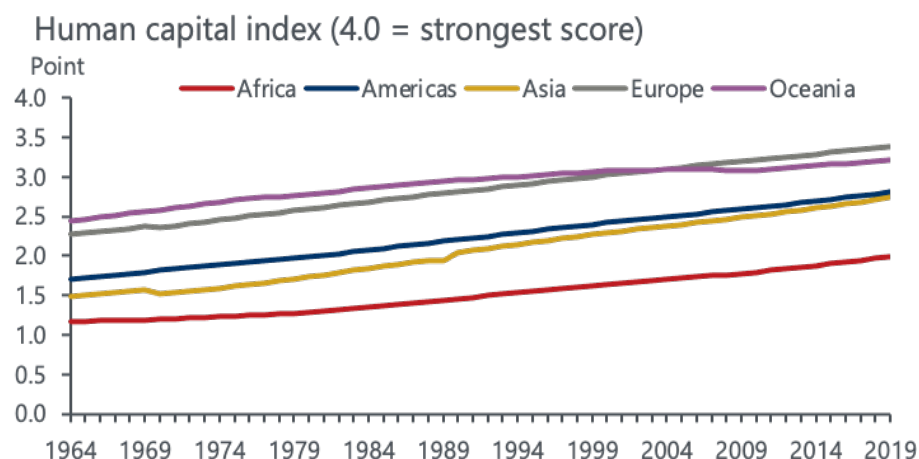
educational attainment have also not translated to equally successful increases in secondary and post-secondary education.

The level of human capital and skills differs widely between continents and over time

We next look at levels of tertiary educational attainment across Africa, which is indicative of a country's readiness to adopt advanced digital skills and innovate. The gross enrolment of populations at tertiary institutions differs widely across the continent. Mauritius has the highest enrolment rate with 38.7% of the adult population having attended some form of tertiary education, while on the opposite side of the spectrum Eritrea has an enrolment rate of only 2.6% (UIS, 2022).

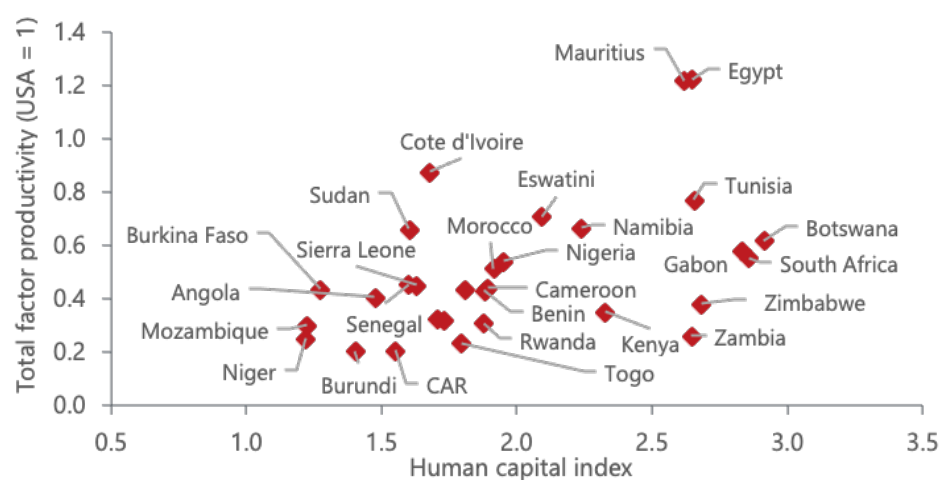
Most countries are below the global average for gross tertiary enrolment of 35%, with the Africa average (excluding North Africa) of 8.6% being very low. The MENA average of 37.9% is much higher, and four of the top five countries on this list are from the North African region: Algeria, Tunisia, Egypt and Morocco. While high mean years of schooling are positively correlated with gross enrolment for tertiary education ratios (as expected), we see that some countries are better than others at converting levels of secondary education into post-secondary education. South Africa and Botswana, for example, perform comparatively worse in the rankings for enrolment in tertiary institutions compared with the rankings for mean years of schooling.

In most African countries it is projected that the proportion of 25- to 29-year-olds attaining post-secondary education will nearly double by 2050 (WIC, 2018). Generally speaking, North Africa outperforms the rest of the continent in this regard. The proportion of 25- to 29-year-olds attaining post-secondary education in Egypt is expected to increase from the current figure of around 36.5% to 64.9% by 2050. These ratios are expected to more than double in Morocco and Algeria over the next three decades: In Morocco, from 18.6% to 45.7%, while in Algeria, from 23.2% to 49.7%. While also expected to show strong growth, the corresponding figures for the rest of the African continent are much lower. In the west, the best-performing country is Gabon, with this ratio expected to increase from 16.6% to 30.7% by 2050, while that of Nigeria is expected to increase from 17.9% to 29.8% over the same period. In the east, the top-performing country is Kenya (from



Source: Penn World Table, 2019

Human capital and total factor productivity in Africa

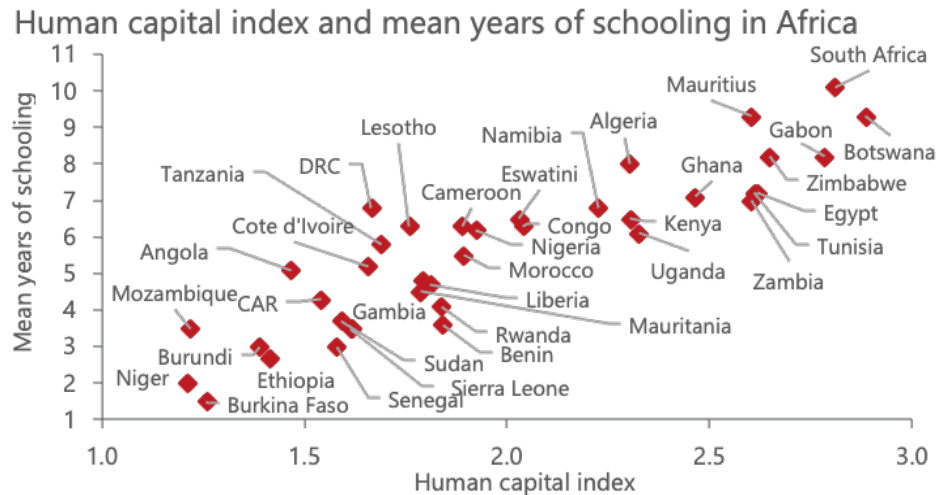


Source: Penn World Table, 2019

12.6% currently to 24.0% by 2050). While regional laggards include Rwanda (from 4.1% to 7.1%) and Ethiopia (from 3.0% to 6.6%). Furthermore, Southern Africa will see some of the weakest performances in this regard. At the one end of the spectrum, Botswana records a commendable performance with enrolment expected to increase from the current figure of around 26.5% to 44.1% by 2050, followed by Zambia (from 15.8% to 26.9%). In turn, Angola and Mozambique are expected to maintain some of the lowest ratios globally, with Angola's figure expected to increase from a mere 0.8% to 2.1% while that of Mozambique is expected to increase from 1.3% to 3.1%. Regional giant South Africa is expected to see its ratio double from 10.6% to 21.4% by 2050. Nevertheless, most African countries are expected to have levels of post-secondary education which will be below the global average over the next three decades – highlighting the urgent need for interventions to develop skills which will make African countries competitive in the 4IR.

There is a strong link between a country's human capital and total factor productivity

The level of human capital and skills differs widely between continents and over time. While human capital and skills on the African continent have improved over time, there remains a gap with other continents (Penn 2019). Of greater concern, the disparity between Africa and the rest of the world has widened slightly over the years. While the



Sources: Penn World Table, UNESCO Institute of Statistics, World Bank 2020

Human capital and schooling are two inextricable parts of skills development

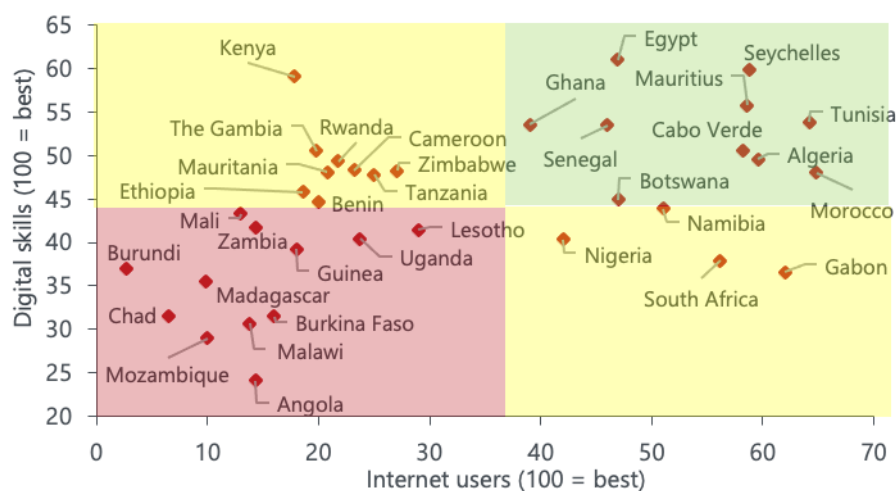
fast pace of Asia's human capital growth has contributed to this expanding gap, the fact remains that Africa is trailing its peers in other continents and the rest of the world.

There is a strong link between a country's human capital and total factor productivity: increasing the skills capacity of a country's population also improves the efficiency level of that country's inhabitants. Furthermore, while there is a large gap in the human capital level between Africa and the rest of the world, human capital also differs widely within Africa (Penn, 2019). A large cluster of countries has lower levels of human capital and total factor productivity, with a striking geographic or regional divide. Human capital tends to be higher in Southern African and North African countries, with Botswana, South Africa, and Zimbabwe registering the best performances in the south, and Egypt and Tunisia dominating in the north. Gabon is the standout performer from a West African perspective, followed by Ghana, while Kenya and Uganda are the best performers in the east. These latter two countries, however, still lag behind some peers in North, Southern, and West Africa.

A country's level of human capital and its mean years of schooling are highly correlated: as the level of schooling increases, so does human capital. Human capital and schooling are two inextricable parts of skills and skills development. The level of human capital is a proxy for the current state of skills within a country, while the mean education level indicates how widely these skills are disseminated and how we expect them to grow and develop in the future. Again, the North African and Southern African countries are on top of this list, with South Africa and Botswana in particular standing out from the rest on both metrics.

As is the case with human capital and education, the relative distribution of digital skills between African countries is highly unequal. Human capital and education facilitate the transfer of skills to populations, with digital skills being one of the most highly sought-after skill groupings. There is a notable correlation between the presence of digital skills in a country and its internet usage (World Bank GovData360, 2022). This is because the development of digital skills is enhanced through the internet and other online forms of learning. Digital skills development and achieving success in the digital space require curiosity to learn, but both outcomes require internet access.

Digital skills vs internet usage in Africa



Source: World Bank GovData360, 2020

As in the previous graphs, North African and Southern African countries are at the top of the mix, with the notable exception of the island nations: Mauritius, Cabo Verde and the Seychelles. These nations have increased access to the internet and the digital skills needed, which likely relates to their small populations and service-orientated business sectors, like tourism or online services.

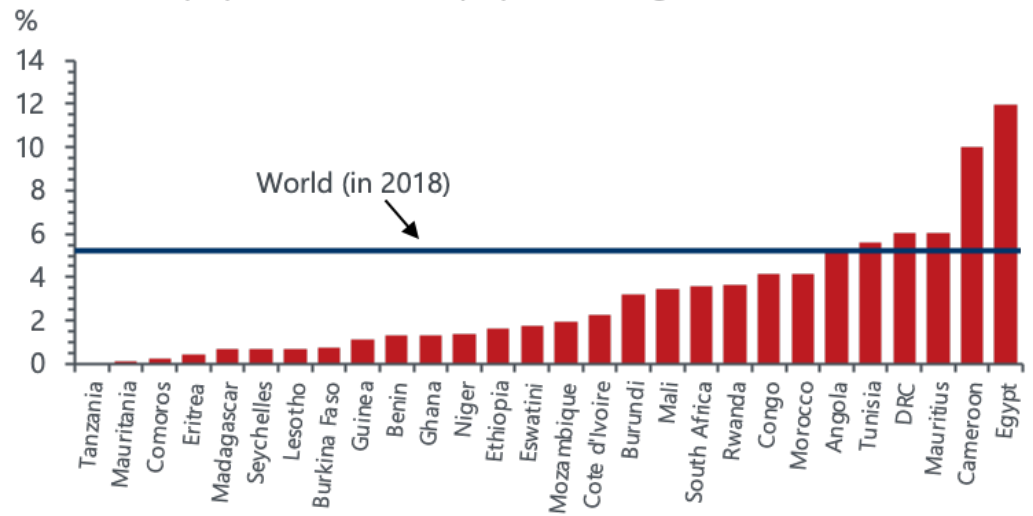
African countries are increasingly turning to Technical and Vocational Education Training (TVET) programmes to upskill workers in preparation of the digitalisation of work and adapting to the 4IR (ILO 2, 2020). Moreover, digitalised TVET platforms have the distinct advantage of being able to provide a wide range of learning programmes to large audiences at low costs, giving rise to massive open online courses (MOOC), such as edX and Khan Academy.

The COVID-19 pandemic has accelerated the shift to digitisation in TVET and education in general as governments strive to ensure the continuity thereof during crisis times which limit in-person learning. For example, in Côte d'Ivoire, the ministry responsible for TVET established an online education platform *Ma formation en ligne*, which provides learning in all fields and at all TVET levels through free online courses (GPE, 2020). Although the pandemic highlighted the increased necessity of e-learning programmes, it also exposed the challenges faced by some African governments to roll out such programmes.

There is currently a dearth of data regarding TVET participation in Africa, especially for contemporary data and data that reflects the various levels (secondary, post-secondary and tertiary) of TVET. Data from before the pandemic shows that participation in TVET among African youth has been low. Looking at the number of vocational pupils in secondary education as a ratio of the population aged 15-24 (UIS, 2022), the participation rates vary between 0.1% (Tanzania in 2018) and 12.0% (Egypt in 2018) for countries with available data. Most African nations have participation rates below the global figure of 5.2% for 2018.

The relative distribution of digital skills between African countries is highly unequal

Vocational pupils* as ratio of population aged 15-24



*vocational pupils enrolled in secondary education in a single year, ranging from 2012 to 2019 depending on data availability

Sources: UNESCO Institute for Statistics, UN Population Division

The COVID-19 pandemic has accelerated the shift to digitisation

We see countries such as Egypt, Mauritius, and Tunisia that have high levels of digital skills and internet usage as also leading in the participation of TVET on the continent. The lack of access to the internet, due to a lack of infrastructure and equipment or high cost, is a key constraint for expanding TVET through digitisation (GPE, 2020). However, even in countries such as South Africa and Morocco where access to the internet is less of a problem, the participation in TVET may be low due to a deficiency of digital skills or knowledge to access e-learning programmes or other constraints. Such constraints may include negative perceptions about the quality of TVET, poor training of TVET educators, a lack of credible certifications for TVET programmes, and high costs of TVET programmes (ILO 2, 2020).

SKILLS DEMAND VS SKILLS SUPPLY

THE SKILLS MISMATCH

A skills mismatch is defined by the International Labour Organisation (ILO) as “a discrepancy between the skills that are sought by employers and the skills that are possessed by individuals” (ILO, 2020). In the face of a skills mismatch, productivity is sub-optimal, which leads to higher levels of unemployment. The skills mismatch can arise when education and training do not match the jobs available, but also when skills become obsolete due to digitalisation and technological advancement.

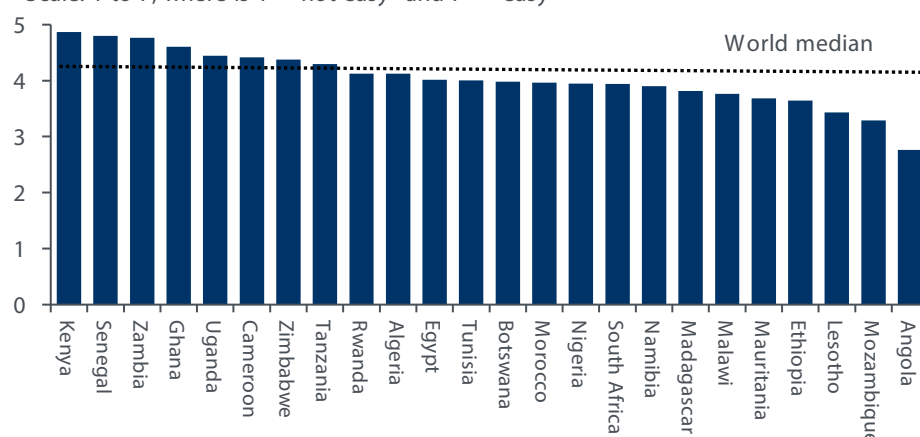
In addition, weak quality control besides poor coordination and regulation of training providers could result in suboptimal outcomes. Many firms operating in the private sector in Africa, particularly in North Africa, identify the skills shortages and mismatches as a major constraint to their business activities (ILO, 2020). The graph below depicts the severity of this constraint across the region. It shows that many African countries, including Angola, Mozambique, Namibia, and South Africa, fall below the world average in terms of the ease of finding skilled employees. This suggests that it is particularly difficult for employers in these countries to find people with the skills required to fill their vacancies. While some African countries, such as Kenya, Senegal, Zambia, and Ghana, come in above the global average, this does not necessarily mean that employees are highly skilled. Rather, it suggests that there is a better match between the level of education and training and the skill level required by firms in the economy.

While shortcomings in educational attainment across the African continent provide the most likely explanation for the skills gap, it can be more nuanced than this. In countries such as Egypt, Tunisia, Algeria and Botswana, for example, a large share of the population (over 30% in most cases) attends tertiary education. However, the unemployment rate of individuals with advanced education remains high (above 20% in general). This is

The skills mismatch can arise when education and training do not match the jobs available, but also when skills become obsolete due to digitalisation

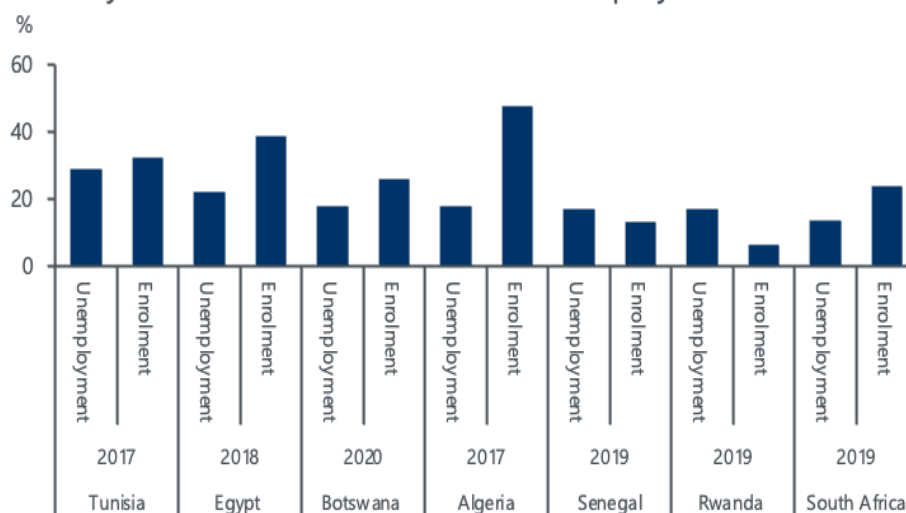
Ease of finding skilled employees, 2019

Scale: 1 to 7, where 1 = "not easy" and 7 = "easy"



Source: World Bank, 2022

Tertiary education enrolment rate vs unemployment rate



Source: World Bank, 2022

The chosen fields of study do not always produce the knowledge and skills required by the economy

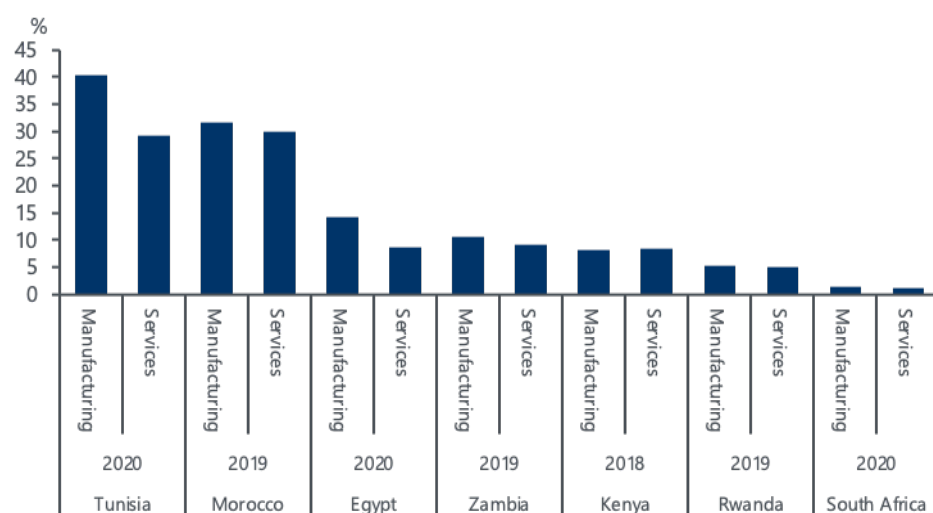
depicted in the graph below. This suggests that either there is a mismatch between the number of job openings and the number of new entrants in a given field in the labour market, or that the chosen fields of study do not produce the knowledge and skills required by the economy. In North African countries, in particular, a historically strong dependence on the public sector for employment has meant that formal education pathways have been targeted at public sector requirements, while the knowledge and skills required by the private sector have often been neglected (World Economic Forum, 2017: 9).

THE SKILLS MISMATCH AT THE SECTORAL LEVEL

The World Enterprise Survey by the World Bank serves as a useful data source for understanding the skills shortages and mismatches at a more granular level (World Bank, 2022a). The survey is a representative sample of an economy's private sector at firm-level. The graph below shows the share of firms in both the manufacturing and services sectors that identify an inadequately educated workforce as a "major constraint". The results suggest that firms, particularly in North African countries, perceive an inadequately educated workforce to be a major constraint, with Tunisia and Morocco taking the lead overall with a share of more than 30% of firms. These survey results further hint that there is a mismatch between the knowledge and skills produced by the relatively well-developed tertiary education systems in North Africa and the knowledge and skills required by firms in these economies. While the share of firms identifying an inadequately educated workforce as a major constraint was much lower in other African countries, such as Kenya, Rwanda, Zambia, and South Africa, this should not detract from the importance of formulating policies that aim to ensure a better match between education systems and the skills required at the sectoral level, and importantly, sectors that are important for future economic production.

The skills gap is also perceived to be more salient in certain manufacturing and services subsectors. In Tunisia and Kenya, for example, firms in the textiles & garments industries view an inadequately educated workforce as a major constraint, whereas in Morocco firms in manufacturing industries that exclude food and garments see the skills gap as

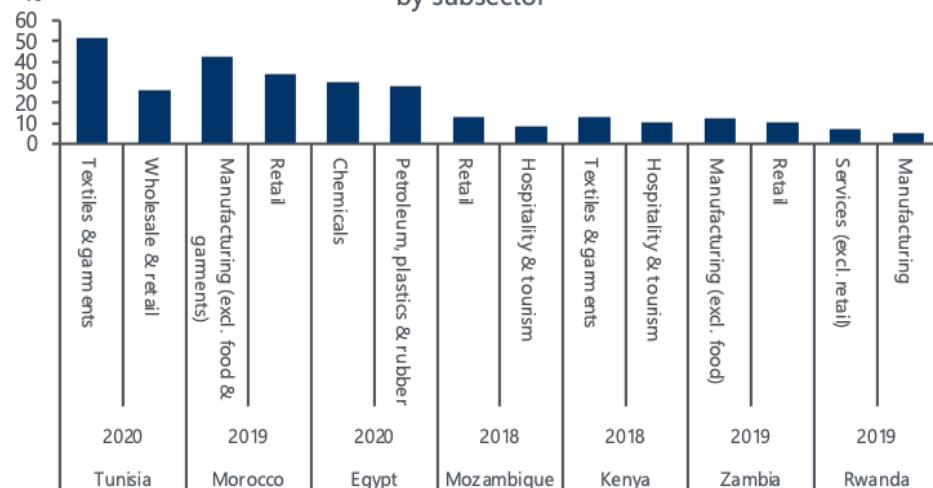
Firms identifying an inadequately educated workforce as a major constraint



Source: World Bank, 2022

The skills gap is perceived to be more salient in certain manufacturing and services subsectors

Firms identifying an inadequately educated workforce as a major constraint by subsector



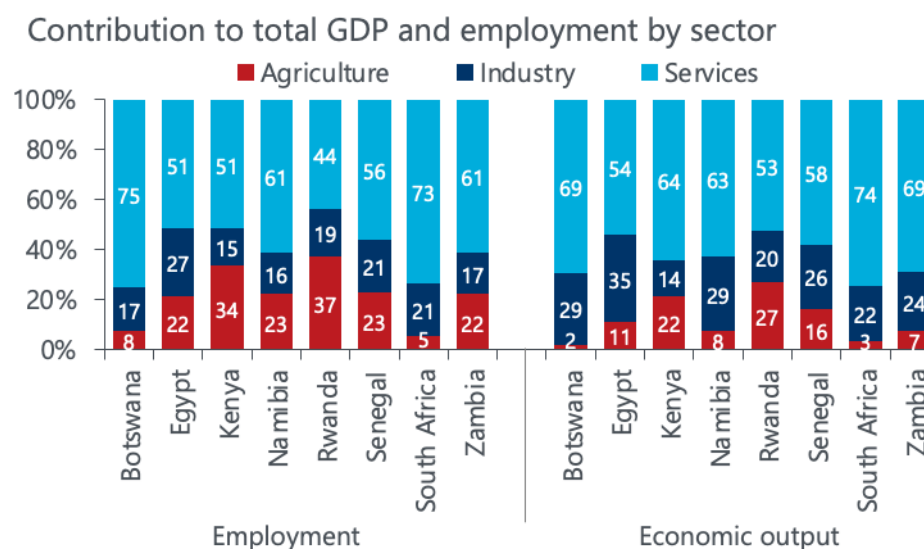
Source: World Bank, 2022

a serious problem. In Egypt, the skills mismatch appears to be more prevalent in heavy industries, such as chemicals and petroleum, plastics & rubber. This data suggests that as industrial expansion has become entrenched, the skills and capabilities of the workforce have not kept up with the skills and capabilities required by firms operating in specific subsectors.

THE RELATIONSHIP BETWEEN SKILLS ,GDP AND EMPLOYMENT

The structure of an economy will have a direct bearing on the employment profile of that country, and consequently, the current and to some extent also future demand for skills. However, it should be noted that the proportional contributions to economic output and employment differ markedly due to the labour-intensity of each sector, and more specifically, the composition of the largest subsectors.

For instance, the agricultural sector accounts for around 23% of total employment in Namibia and 22% of employment in Zambia. However, agriculture accounts for just 8%



Sources: ILO, Oxford Economics Africa, 2018-20

The structure of an economy will have a direct bearing on the employment profile of that country

of GDP in Namibia and 7% of GDP in Zambia. The difference between the proportional contribution of agriculture to employment versus its contribution to GDP equates to nearly 15% in both countries, with agriculture accounting for a much larger share of employment than economic output. This is indicative of the labour-intensive nature of some agricultural activities, but also reflects the persistently low productivity per individual in the sector. In contrast, Namibia's industrial sector accounts for around 29% of GDP, but only accounts for some 16% of employment. Another interesting example is Kenya, where the services sector accounts for around half of total employment, but for nearly two-thirds of total GDP. This is again due to the disproportionate contribution of agriculture to employment as opposed to GDP: Kenyan agriculture accounts for around a third of employment, but for just 22% of GDP.

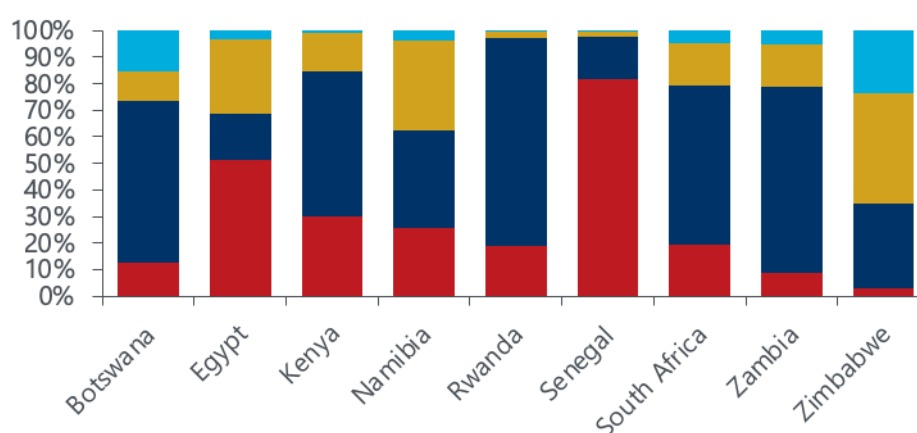
THE CHICKEN OR EGG CONUNDRUM

When assessing the dynamics between skills demand and skills supply within an economy, a conundrum regarding causation emerges. Similar to the-chicken-or-the-egg archetype, the demand for specific skills is both a product of the size of the sector requiring those skills, as well as a factor in determining the size of the aforementioned sector. The symbiotic relationship between a good supply of skills for a sector that is showing strong growth also has converse implications: the inability to find the necessary skills to develop a sector will hamper the development of that sector, thus reducing the demand for those skills. Furthermore, a country's employment makeup from a sectoral perspective is indicative of the skill demands in those sectors, and the availability of those skills in the economy. This point – that the employment makeup of a country is determined by the structure of an economy and the availability of skills to support that structure – holds important implications for economic growth, development and competitiveness.

When looking at the schooling level of employees in each sector, the analysis suggests that agriculture in many cases contributes more to employment than to GDP, which is reflective of the relatively low productivity and education of workers in the agricultural sector. In Rwanda, around 97% of employees in the agricultural sector either have basic

Schooling level of individuals employed in agriculture

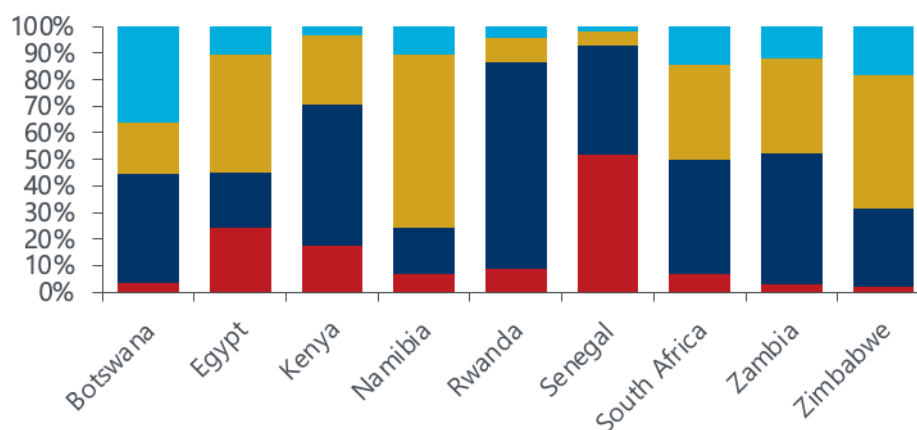
(2018-20) ■ Less than basic ■ Basic ■ Intermediate ■ Advanced



Sources: ILO, Oxford Economics Africa

Schooling level of individuals employed in industry (2018-20)

■ Less than basic ■ Basic ■ Intermediate ■ Advanced



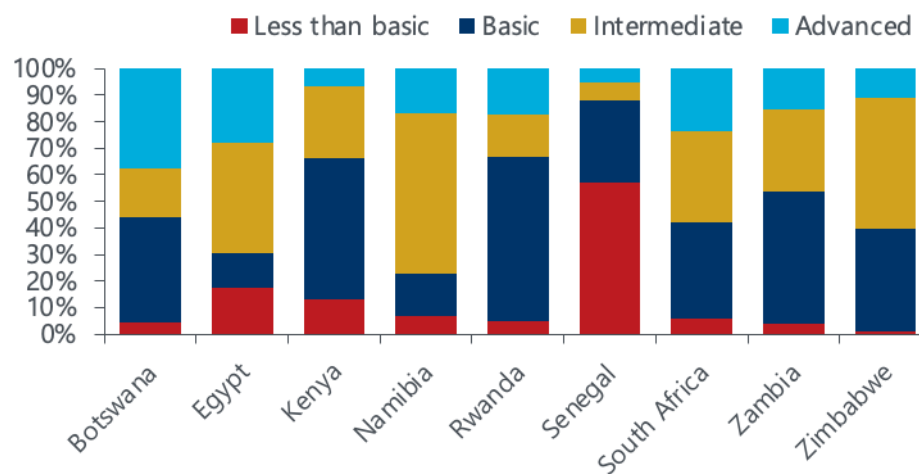
Sources: ILO, Oxford Economics Africa

or less than basic education levels. This is significant because agriculture accounts for around 37% of employment in Rwanda. The ratio – the proportion of individuals with basic or less than basic education levels in the agricultural sector’s workforce – is also at around 97% in Senegal, and is estimated to be over 70% in Botswana, Kenya, South Africa, and Zambia.

The ratio of relatively low-skilled labour to total employment drops somewhat when looking at the industrial sector. When looking at this ratio, the median contribution of low-skilled labour to employment in the industrial sector among countries included in this analysis comes in at around 50%. The corresponding figure for the agricultural sector is nearly 80%.

The shortage of skills to develop a sector will hamper the development of that sector and possibly private sector more broadly

Schooling level of individuals employed in services (2018-20)



Sources: ILO, Oxford Economics Africa

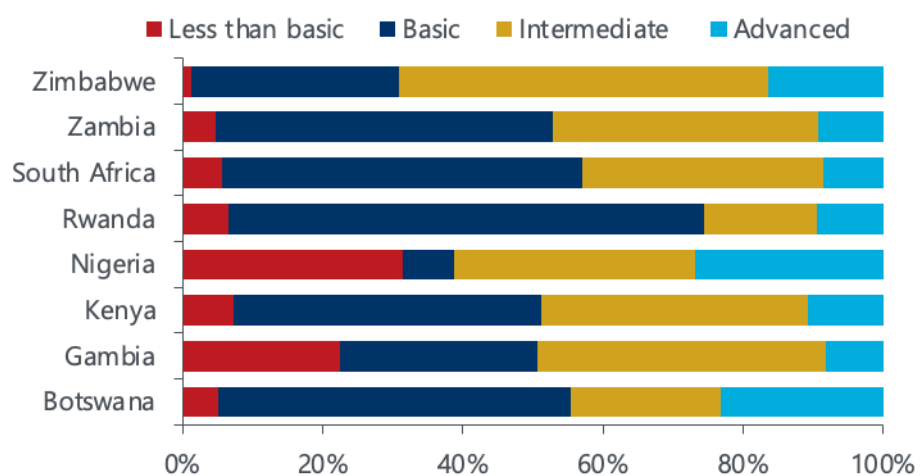
Sectors that are considered strategic or potential high-growth sectors will demand skills higher up in the skills spectrum

This trend continues when looking at the services sector. The median contribution of low-skilled labour to employment in the services sector among countries included in this analysis comes in at around 44%. This transition away from less skilled labour is even starker when looking at individuals with less than basic education. In the agricultural sector, the median contribution of individuals with less than basic education to total employment is estimated at nearly 20%. In the services sector, this figure drops to less than 6%. In contrast, the contribution of individuals with advanced education is much higher in the services sector than in the agricultural sector. Again, looking at the median contribution to total employment among countries considered in this analysis, the contribution of individuals with advanced education comes in at around 17% in the services sector, which is markedly higher than the corresponding figure for the agricultural sector of around 4%.

This breakdown of skills demand by sector viewed in the context of each sector's contribution to GDP holds important information regarding the potential for future job creation and competitiveness. From the analysis above we see a clear transition, given current economic structures, towards demand for higher skills from the agricultural sector through to industry and then to services. In addition, we see a productivity trend running in the same direction: in all the countries considered in this analysis except for Botswana (which is highly dependent on its tourism sectors), the services sector makes a larger contribution to GDP than it does to employment, roughly suggesting each services employee makes a larger contribution to economic output than those in the agricultural sector. Looking ahead, this suggests that sectors that are considered strategic or potential high-growth sectors, which tend to be industrial or services-oriented, will demand skills higher up the skills spectrum. Given the positive externalities that are associated with development of these sector, the required skill acquisition may warrant targeted public support.

As mentioned above, there are complex dynamics between the demand and supply of skills in the context of evolving economic structures. A snapshot of the current employment makeup in relation to each country's economic structure is indicative of

Schooling level of unemployed individuals (2018-20)



Sources: ILO, Oxford Economics Africa

current market demand for labour, but does not address the matter of supply, or indeed, future demand.

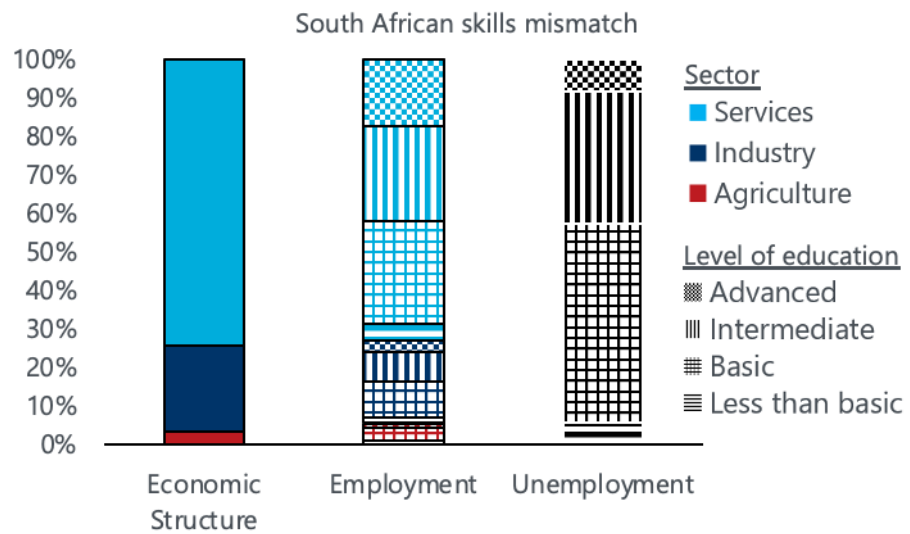
Another informative measure of imbalances between demand and supply is the breakdown of the educational attainment of unemployed individuals. This shows to what extent current economic structures are unable to absorb individuals in the labour force, broken down by education attainment. Put differently, this shows what levels of skills are currently in oversupply.

For example, these figures show that a significant number of unemployed individuals in Nigeria, Botswana and Zimbabwe have attained an advanced level of education. The demand for these specific skills in these economies seems to be below that of supply, or that labour market rigidities prevent these individuals and potential employers from connecting. In turn, in Zimbabwe, Zambia, South Africa and Botswana, individuals with less than basic education present only a small part of unemployed people. While measurement issues should be considered, this suggests that these economies are able to create employment for individuals willing to assume low-skills jobs while unable to create jobs for more skilled individuals. In Nigeria and Gambia, individuals with less than basic education, however, make a significant contribution to total unemployment.

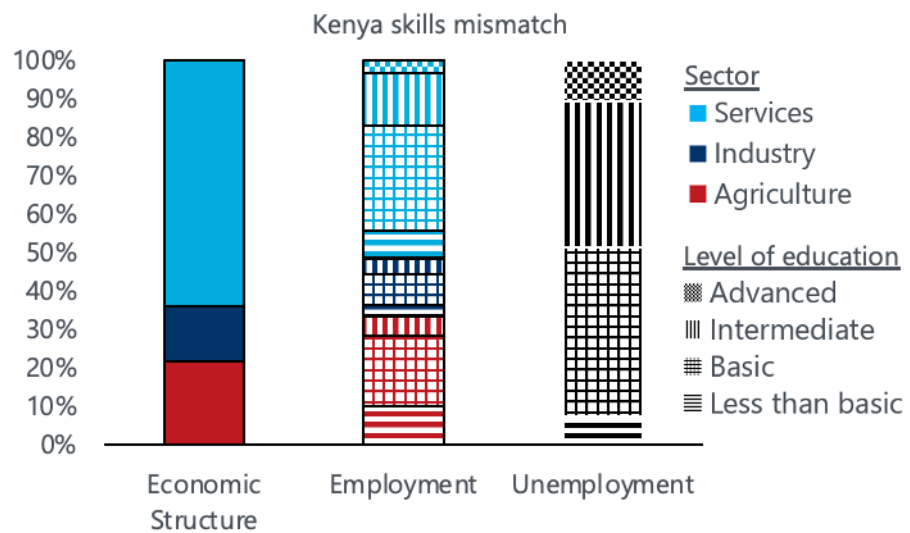
Combining the data for economic structures, employment by sector & education level, and unemployment by education level produces an interesting holistic picture. In South Africa, there is a strong correlation between the economic structure of the economy and each sector's contribution to employment. When looking at the educational demand by sector, the services sector is by far the largest employer of individuals with advanced education. While a substantial number of individuals with basic education have found employment in the services sector, the sector is a drawcard for higher levels of skills. In fact, more individuals with intermediate education work in the services sector than in the agricultural - and industrial sector combined. Most individuals working in the industrial and agricultural sectors have basic education, with a very small number of individuals with advanced education finding employment in these sectors.

The breakdown of the educational attainment of unemployed individuals shows imbalances between supply and demand

The contribution of individuals with advanced education to total employment exceeds advanced education's contribution to unemployment



Sources: ILO, Oxford Economics Africa 2022



Sources: ILO, Oxford Economics Africa 2022

Among the unemployed individuals, the number of those with less than basic education roughly matches the number with advanced education. However, given that the economy employs more individuals with advanced education than those without basic education, it implies that advanced education increases your likelihood of finding a job due to South Africa's economic structure. Again, put differently, the contribution of individuals with advanced education to total employment exceeds advanced education's contribution to total unemployment. This ratio does not hold for the intermediate and basic education levels. It should also be noted that the breakdown of unemployment by education is a reflection of South Africa's education system, with most unemployed individuals having attained at least basic education levels.

The picture for Kenya looks quite different. Firstly, the correlation between GDP contribution and employment contribution by sector is not that strong – the services sector disproportionately contributes to GDP, while agriculture disproportionately contributes to employment. Individuals with basic education dominate employment in

all three sectors. In turn, individuals with advanced education are most present in the services sector, but this contribution is marginal, and close to insignificant in industry and agriculture. Finally, in contrast to South Africa, the contribution of individuals with advanced education to total employment is below advanced education's contribution to total unemployment. The contribution of individuals with basic or less than basic education to employment exceeds these education levels' contribution to unemployment.

CASE STUDY: THE SOUTH KOREAN EXPERIENCE

South Korea provides an interesting example of how an industrial economy was able to transition to a new high tech-led economy by developing its science and technology capacity. Through investment in both human capital and infrastructure over the past two decades, South Korea was able to establish the IT industry and, to a lesser extent, biotech, as key drivers of economic development. A strong focus on research and development (R&D), through both government and private investment, drove the technological shift, while securing highly qualified workers was also key to increasing the efficiency of R&D investment. By reforming science education at the primary and secondary levels, and focusing on engineering and vocational training, the government was able to cultivate the science and technological manpower and reduce job mismatches required for the economic shift (Brookings, 2012). These policy changes have seen real GDP growth at an average of 4.8% p.a. over the past two decades, while GDP per capita has grown from around \$7,600 in the early 1990s to \$35,000 in 2021.

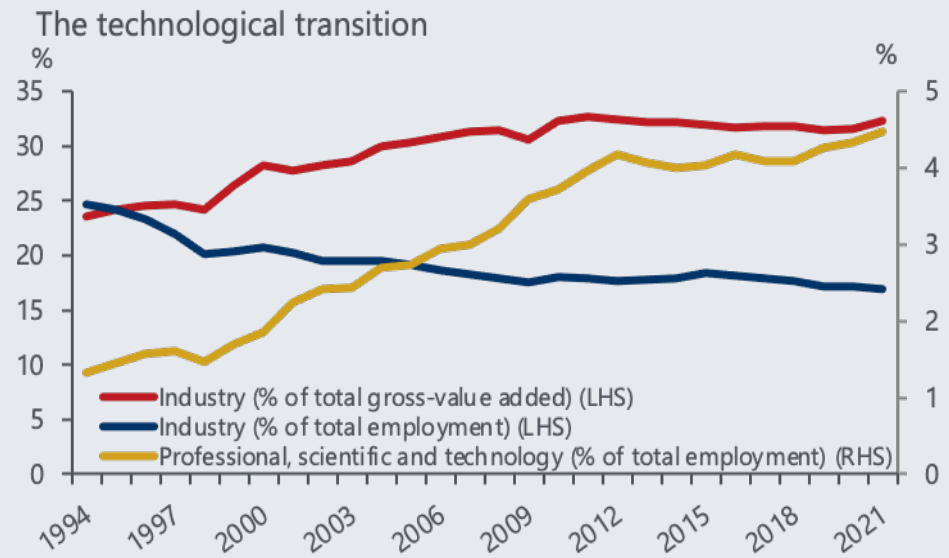
Economy is six times bigger than it was in 1990



Sources: Bank of Korea, Haver Analytics

The graph below shows how the number of people employed in professional, scientific, and technological activities in South Korea increased as a percentage of total employment as education and training in these fields became a policy priority. A more technologically qualified workforce meant that the full potential of R&D investments could be harnessed, which drove the continued growth of industry (industrial electronics, bioengineering, micro-electronics, fine chemistry, and aerospace) despite a decline in the number of people employed in industry. Although jobs in heavy industry were displaced by automation, the technological expansion created employment opportunities across different sectors and skill levels. The workforce was better equipped to fill these positions thanks to a reformed education system.

CASE STUDY: THE SOUTH KOREAN EXPERIENCE CONT.



Sources: Statistics Korea, Oxford Economics

South Korea, therefore, provides a good example of how the chicken or egg conundrum can be addressed in real life. By simultaneously investing in infrastructure, R&D and education and training, the government was able to improve the overall productivity of the economy and contribute towards the development of the sciences and technology sectors.

ADDRESSING THE SKILLS GAP

Getting an accurate sense of the magnitude of the skill shortages and mismatch between skills demand and skills supply is a complex endeavour. On the supply front, most African countries have some ground to cover when looking at conventional measures of human capital. On the demand front, numerous survey findings suggest that an inadequately educated workforce is a major constraint to doing business. Furthermore, when looking at the skills makeup of some African countries' workforce, it is clear that obtaining an advanced level of education greatly reduces the probability of being unemployed, while there is an abundance of unemployed individuals with basic or less than basic education levels. While measuring the magnitude of skills mismatches in any reliable and accurate quantitative manner is fraught with data limitations, there are some learnings on how to address these mismatches.

Economic structures are constantly evolving, either due to internal developmental policies or due to exogenous technological developments. Consequently, addressing the skills gap requires a dynamic, forward-looking approach. As is seen from the South Korean experience, this requires the simultaneous investment in education and training, while at the same time providing the infrastructure and policy framework needed for sectors of the future to develop. Managing both the supply of and demand for skills will create synergies that are foregone when strictly focusing on a single dimension. Another important finding is that the financial burden of investment in education and training should not fall on the fiscus alone – crowding-in private provision of education and training will make for a much more dynamic labour force.

It is also clear that a forward-looking education curriculum requires a focus on digital skills and entrepreneurial skills. Importantly, both digital skills and entrepreneurial skills should be embedded in the entire curriculum rather than taught separately. Although a separate digital or entrepreneurial skills classes may be useful during early childhood education, children should be acquiring digital and entrepreneurial skills throughout the education programme. Digital skills are not only needed in ICT professions, but in a variety of sectors, from agriculture to industry. Accordingly, a number of African countries have undertaken initiatives to develop digital skills and advance digital literacy. A number of these case studies are discussed below. Similarly, in today's workplace, entrepreneurial skills are needed not only for owners of firms but also for employees in large firms to take initiative and bring innovative solutions.

A forward-looking education curriculum requires a focus on digital skills

1. CÔTE D'IVOIRE

The National Digital Development Strategy is aimed at making Côte d'Ivoire the digital hub of the West African region

The ICT sector constitutes one of the key pillars of the Ivorian economy, contributing around 8% of the country's total GDP. In this regard, government has set out to make Côte d'Ivoire the digital hub of West Africa, developing various policies and strategies aimed at achieving this. The overarching framework on this front is the National Digital Development Strategy 2021-25, which involves 32 reforms and 96 projects totalling CFAfr2.0trn. The strategy is based on seven fundamental pillars (listed below) that are meant to promote economic growth through, inter alia, generalising the use of digital technology.

To further drive the digitalisation process in the country, there are various smaller projects that are more focused and span a shorter period. One such project aims to develop the FinTech sector in Côte d'Ivoire. Running from 2022 to 2024, its target is to increase the penetration rate of digital financial services from 34% in 2017 to 60% in 2024. Though, there are various hindrances to achieving this target. The regulatory framework is inadequate, access to financing is limited, capacity building is weak, and the organisation of the sector is poor (L'Agence de Promotion de l'Inclusion Financière, 2021).

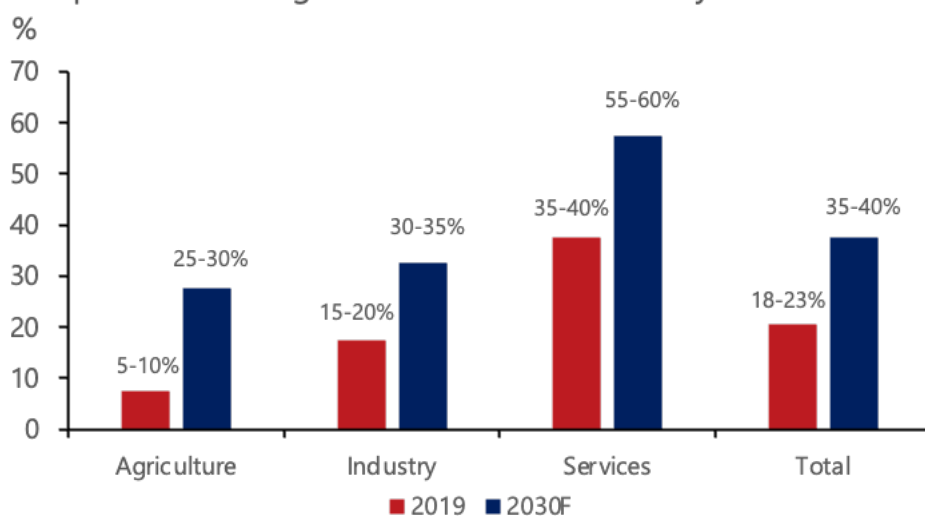
Moreover, government has attempted to increase the employability of the country's large youth cohort. One such attempt was the 'one student, one computer' project, which subsidised the purchase of computers for students. The project is meant to maximise Côte d'Ivoire's impending demographic dividend given that, in 2021, 41% of

Seven pillars of Côte d'Ivoire's National Digital Development Strategy

Digital infrastructures	• Deploy infrastructure that provides affordable and inclusive access to high-speed digital services.
Digital services	• Establish a connected administration of individuals and firms in digital services in key economic sectors.
Digital financial services	• Increase contribution of digital financial services to financial inclusion and development of e-commerce.
Digital skills	• Develop digital skills by strengthening training and operationalising skills needed to stimulate innovation.
Digital economy business environment	• Create business environment conducive to investment and innovation in digital economy.
Innovation	• Promote a digital industry conducive to innovation and value creation.
Cybersecurity and digital trust	• Strengthen cybersecurity by building technical infrastructures to instil trust in digital economy.

Source: CIO-Mag, 2022

Adoption rate of digital skills in Côte d'Ivoire by sector



Source: IFC, 2021

the country's population was under the age of 15. Concurrently, the age dependency ratio was 74%. While the project has achieved some success, poor internet access is a key hindrance. In 2019, only 36% of Ivorians used the internet, which is one of the key prerequisites of the digitalisation process. This is due to both poor coverage and high costs.

The above figure illustrates that, according to the IFC, digital skills are anticipated to be adopted at a swift pace over the next decade across all sectors (International Finance Corporation, 2021). The uptake of digital skills is expected to be the most dramatic in the agricultural sector, which is unsurprising considering the large degree of informality currently present in Côte d'Ivoire's farming practices and the intensifying impact of climate change, which continuously requires innovation in this field. The latter will be key as changes in temperatures and rainfall patterns will affect cocoa farming – the country's main export commodity and a key source of employment, revenues, and economic growth. Adopting 'smart' farming solutions is important to pre-empt the impact and to protect and improve the livelihood of Ivorians. Mining activity, which constitutes a large part of the industrial sector, also needs to be formalised and digitised to increase its efficiency and minimise its impact on the environment. Currently, the focus on this is relatively weak. Finally, the services sector, which constitutes over half of the Ivorian economy, will have the highest adoption rate across sectors as the country's development and formalisation efforts materialise. This will require, *inter alia*, cheaper internet that is readily available. While the National Digital Development Strategy lays a good foundation for the above sectors to adopt digital skills over the medium term, it will be important to provide the required resources and guidance for the strategy to be implemented across sectors. Support in this regard is not yet sufficient.

Côte d'Ivoire's agricultural sector is expected to transform significantly over the next decade

2. EGYPT

Egypt has an Information and Communications Technology (ICT) 2030 Strategy, which contributes towards the objectives of the broader national agenda, "Vision 2030", through building a 'Digital Egypt'. In a nutshell, Vision 2030 aims to ensure a sustainable development path, and sectors such as ICT, extraction and manufacturing are essential to achieving this. A technical skills shortage, however, presents a massive challenge to this ambitious national agenda. Digital Egypt consists of three key pillars, of which the first pillar seeks to address the digital skills shortage:

Digital Egypt is an all-encompassing vision and plan for achieving the ICT 2030 Strategy

Digital skills and jobs: aims to prepare school and university students, graduates, professionals, women, and persons with disabilities to carry out the broader digital mission of an organisation. This is achieved by providing training and building capacities. The strategy is based on a hierarchical approach which starts with digital literacy. This is followed by intermediate technology training programmes, advanced technological training programmes, and finally, a specialised practical master's degree implemented in cooperation with major technology companies and international universities.

The other two pillars are:

Digital transformation: aspires to enhance the role of ICT in public sector services by transforming government services and community ecosystems to *"an entirely digital and data-driven ecosystem, to provide public services in a fast and simpler way"* (MCIT, 2022). Several projects have already been launched to digitise government services, these include the Digital Egypt e-platform, mobile applications, call centres, post offices and citizen service centres.

Digital innovation: aims to *"build and foster an ecosystem that encourages entrepreneurship and spurs creativity"* (MCIT, 2022). Key to achieving this is promoting research and development, backing effective policies on ICT-based innovation, and supporting the networks that incubate creative ideas and converting them to value-added products.

Egypt's digital skills strategy is based on a hierarchical approach



Source: MCIT, 2022

Under the pillar of “*digital skills and jobs*” the Ministry of Communications and Information Technology (MCIT) has launched several capacity building initiatives and projects which provide training opportunities to young people to qualify them for national and international labour markets. These include:

- **Basic Digital Skills Development Programmes:** aims to develop general digital capabilities of students, graduates, job seekers and internet users. Programmes include social media and internet safety, cybersecurity, and artificial intelligence (MCIT, 2022).
- **Youth Enable for Freelancing:** aims to train 20,000 young people on freelancing through e-platforms. The initiative provides online training over two months in areas such as computer networks, programming, operating systems, digital marketing, graphic design, mobile application, website development and Microsoft Office Professional. Training also includes how to find a job through freelancing platforms (MCIT, 2022).
- **Digital Egypt Cubs Initiative (DECI):** aims to upskill around 3,000 top-performing students from schools across Egypt in different fields of technology. The initiative starts with a foundation programme that introduces students to the basics and tools of modern technology. Thereafter, students specialise in one of the following areas: digital arts, software development, network and information security, artificial intelligence, and robotics (MCIT, 2022).
- **Practical Data Scientist Academy – Amazon Web Services (PDSA - AWS):** aims to upskill 500 young people in data analytics and big data with a focus on utilising these for data engineering, formatting, and data visualisation. The programme hopes to develop skill sets required to fill in-demand jobs and contribute to national projects (MCIT, 2022).
- **Egypt University of Informatics (EUI):** located at Knowledge City in Egypt’s New Administrative Capital, the newly established institution is the first specialised university in ICT sciences in MENA. Bachelor, master’s, and doctorate degrees are offered in computing and information sciences, engineering, business informatics and digital arts and design. Students at the university can also participate in projects carried out by the MCIT to build Digital Egypt.

The MCIT has launched several capacity building initiatives and projects

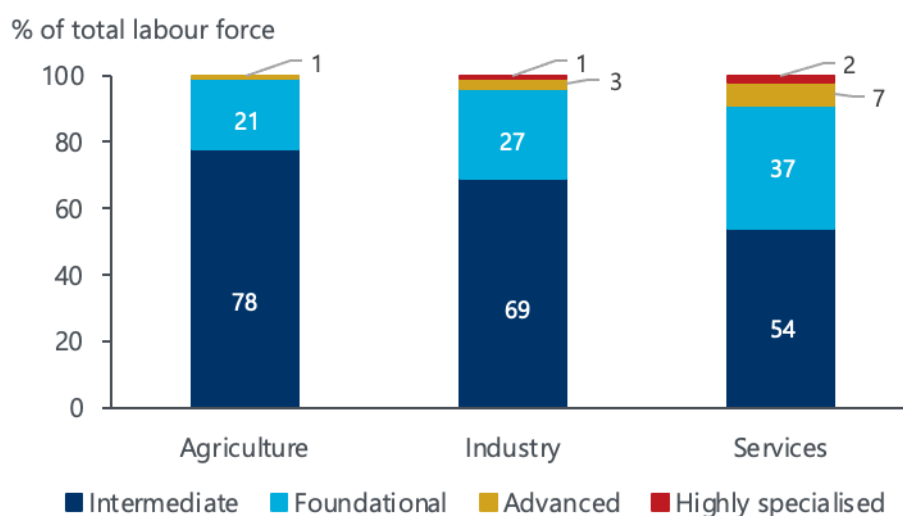
The IT executive arm of the MCIT has also partnered with several international agencies, including the Goethe-Institute, the German Department of Foreign Affairs, Speak-Up Egypt, the Komet-Institut, and the Guide Academy, to improve language skills (English, German and French) with the aim of bridging the language gap between supply and demand for skilled manpower in the local outsourcing sector.

3. KENYA

Dubbed the 'Silicon Savannah', Kenya has a thriving ICT sector and is home to the continent's most cutting-edge start-ups, which are expected to drive digital adoption. The World Bank (2021b) states that more than 50% of all jobs in Kenya will require digital skills by 2030, and the labour force in Kenya will need around 17 million workers with adequate digital skills across various sectors.

The demand for digital skills in Kenya exceeds its current supply

Demand for digitally skilled trained workers by 2030

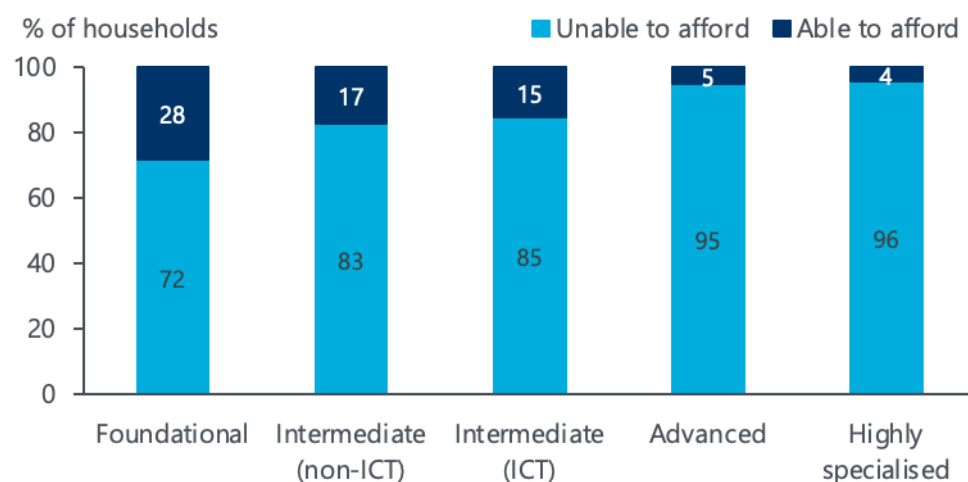


Source: World Bank, 2021

Alas, the demand for digital skills in Kenya exceeds its current supply, and digital literacy in the country remains weak within a global context – Kenya ranked 70th out of 79 countries in the Huawei Global Connectivity Index (Huawei, 2020), 84th out of 134 countries in the Network Readiness Index (Portulans, 2021), and 105th out of 158 countries in UNCTAD's Readiness for Frontier Technology Index (UNCTAD, 2021). This means there is a need to train both existing personnel and the future workforce to ensure a sufficient supply of digitally skilled workers in the job market going forward. To date, the following organisations provide/have provided digital skills training in Kenya:

- 1. Moringa:** Founded in 2014, Moringa is a multidisciplinary computer programming school located in the capital city, Nairobi, which aims to close the skills gap in the African labour market by providing high-achieving students with the necessary technical and professional training to compete in a digital, global economy. More than 4,000 students have been enrolled at Moringa, of which over 3,000 have graduated (Moringa, 2022).
- 2. Digikids:** Digikids is Kenya's leading STEM (Science, Technology, Engineering & Mathematics) educational institution that offers tailor-made coding programmes for children aged 6 to 17. Courses include weekend coding classes, holiday coding boot camps, and workshops (Digikids, 2022).

Households' ability to afford the required digital skills



Source: World Bank, 2021

3. Digital Literacy Programme (DLP): The Kenyan government initiated the DLP – also known by the brand name DigiSchool – in 2016. It is executed through a multi-stakeholder approach with the ICT Authority as the implementing agency. It targets students in all public primary schools and has five main components: i) providing digital devices with preloaded interactive digital content on various topics for students and teachers, ii) capacity building for teachers and implementers, iii) devices with broadband connectivity, iv) providing content for digital learning, and v) establishing local assemblies for digital devices and related accessories. Building teachers' competence in ICT and digital skills has contributed to the programme's success, which benefited over one million students and 91,000 teachers across 19,000 public primary schools by 2017. To date, 21,637 public primary schools have access to digital devices. In addition, 22,927 schools have been connected to power, of which 19,042 are connected to the national grid and 3,239 to solar power. It has been reported that 331,000 teachers have been trained in ICT integration, a further 218,253 on how to implement the Competency Based Curriculum, and 93,009 in the use of ICT and digital devices. A wide range of external and internal partners have been involved, including the Chinese Government, Huawei, and Telkom Kenya (African Union & UNICEF, 2021).

It is estimated that less than 20% of households can afford to pay for the training of intermediate and higher digital skills

Although Kenya has been cited as a leader in terms of ICT initiatives and policies aimed at improving access to technology, it is estimated that less than 20% of households can afford to pay for the training of intermediate and higher digital skills that will be needed over the next eight years (World Bank, 2021b).

4. MOROCCO

Digital transformation is central to Morocco's goal of becoming an industrial hub in Africa. Digital skills are necessary across a variety of manufacturing sectors, such as aerospace, automotive, and textiles, which Morocco hopes to further advance. Like Egypt, however, Morocco also suffers from a technical skills shortage, specifically when it comes to digital skills. To this end, Morocco has implemented several national development programmes aimed at digital economy. These have included Numeric Morocco 2013, Digital Morocco 2020, and most recently, Morocco Digital 2025 (Huawei, 2021). The Morocco Digital 2025 strategy has three main goals:

Through its several initiatives, Huawei plays a key role in developing digital skills in Morocco

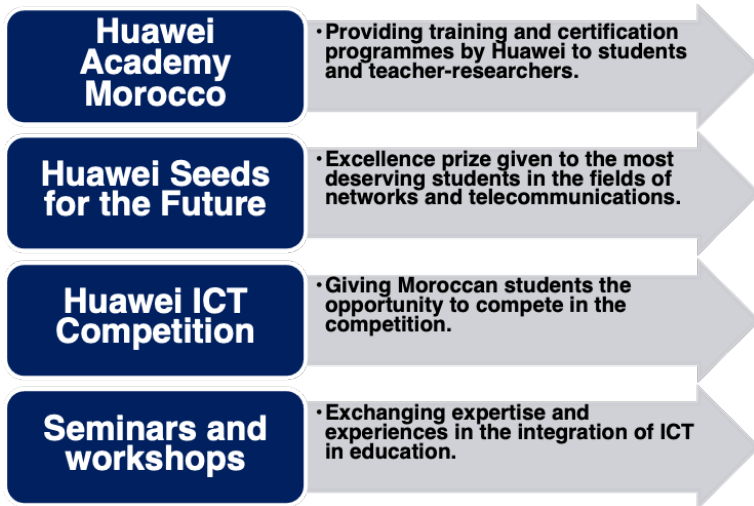
1. **Establish a successful digital administration** through the digitisation of public services.
2. **Establish Morocco as Africa's Digital & Technological Hub** through installing over 2,500 start-ups over the next five years and improving its United Nations E-Government Development Index ranking to be part of the top three in Africa (currently Mauritius, Seychelles, and South Africa) and among the top 40 at the global level – currently ranked 106th out of 193 countries.
3. **Create a more inclusive and egalitarian society through digitisation** by narrowing the digital divide, training 50,000 young people, and developing specific initiatives in sectors such as education, health, agriculture, and handicrafts.

Morocco, however, faces major gaps between the supply and demand of digital skills required to achieve these ambitious digital transformation goals. Therefore, training and skills development are key to creating the “*digital generation*” needed to build the desired digital economy. Several government initiatives have been carried out to address the digital skills gap. Some of these initiatives have targeted educational reform, but the appropriation of this knowledge by students and teachers has often been limited by the nature of the education system, the skills and professional development of teachers, and the implementation of these types of programmes. Against this backdrop, the private sector plays an instrumental role in the development of digital skills in Morocco. Public-private partnerships are becoming especially popular, as they allow the public sector access to the private sector's resources and know-how. One company that is playing an integral role in developing digital skills in Morocco is Huawei.

Huawei: bringing digital to every person, home, and organisation

Huawei's vision is to “*bring digital to every person, home and organisation for a fully connected, intelligent world*” under its Education4All programme (Huawei, 2021). To achieve this, it focuses on three priorities:

1. **Technology:** making digital technologies affordable with scalable, low-cost products and solutions.
2. **Applications:** creating digital ecosystems and building applications for communities and industry.



3. **Skills:** improving society's digital skill set by working with local governments, communities, and other partners.

To realise priority number three, Huawei has entered into a strategic partnership with the Ministry of National Education, Vocational Training, Higher Education and Scientific Research "with the aim of equipping students with ICT skills and thus promoting their integration into the job market" (Huawei, 2021). The partnership between Huawei and the ministry is based on four main axes:

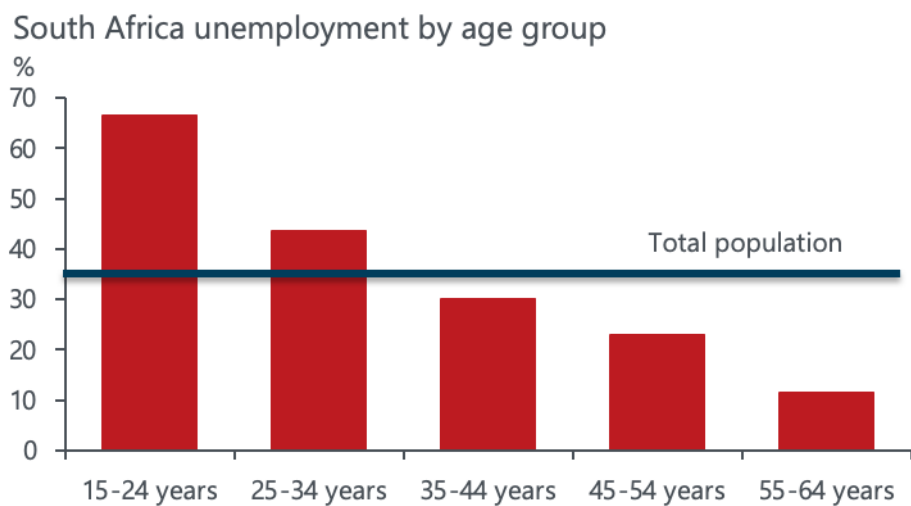
So far, Huawei has entered into partnerships with 21 Moroccan universities and higher education institutions. The Learn On programme was also launched in 2020 to address some of the challenges posed by the COVID-19 pandemic. This initiative allowed over 3,000 students to pursue their studies virtually, while around 500 students have received technical certifications in 5G, artificial intelligence, and Big Data.

Huawei has entered into partnerships with 21 Moroccan universities and higher education institutions

5. SOUTH AFRICA

South Africa has a skills shortage as well as a major unemployment problem – the high youth unemployment rate is of particular concern. Many young South Africans who are eager to gain future-ready relevant skills that will boost their chances of finding employment have been left jobless by the COVID-19 pandemic. The official unemployment rate is 34.5%, with the 'broad' unemployment rate standing at 45.5%. South Africa's Minister of Higher Education, Science and Technology, Blade Nzimande, says that through education the government and the private sector can help provide fresh new perspectives on how to turn South Africa's socio-economic fabric around in a post-COVID-19 world.

Microsoft and Afrika Tikkun have partnered with the Public Service Sector Education and Training Authority



Source: StatSA, 2022

GOVERNMENT AND PRIVATE SECTOR PARTNERSHIPS

There are a number of exciting initiatives taking place across South Africa aimed at bridging the digital divide. Microsoft and Afrika Tikkun have partnered with the Public Service Sector Education and Training Authority to provide online opportunities for 20,000 unemployed young people through the Global Skills Initiative South Africa. Registration closed in 2021, with course durations ranging from a minimum of 5:30 hours to 34 hours at the most, depending on the training course selected. The ultimate aim is to place 50,000 prospective job seekers.

Another programme, between I4G and Coursera, aims to upskill thousands of young Africans in soft and technical skills. This programme is part of I4G's goal to train one million young people across the African continent in tech for free and bridge the digital divide. Up to now, I4G has trained over 66,000 African youths with high participation rates recorded in the following countries: Nigeria, Kenya, Ghana, Tanzania, Cameroon, South Africa, Uganda, Rwanda, Botswana and Benin. Coursera's Global Skills Report 2021 shows that 500,000 users, who are sharpening their skills through online courses from

some of the world's top universities, registered in South Africa. About 55% of South Africa's user base are learning these courses on mobile devices, which Coursera notes is high compared with the rest of Africa. Overall, the Global Skills Report notes that a great degree of learning takes place via the use of mobile devices, despite the fact that Africa faces numerous connectivity challenges, including patchy coverage and high bandwidth costs.

INVESTING IN SOUTH AFRICA'S DIGITAL FUTURE

Google and Meta are investing in massive subsea cables, bringing internet infrastructure to millions across the continent. Google's Equiano subsea cable runs from Portugal along the west coast of Africa and reportedly reached South Africa at the beginning of August 2022. It is set to boost broadband speed and improve overall connectivity reliability. Equiano should ultimately lead to lower internet costs in South Africa, unlocking economic development, which will in turn help to create new jobs. Meta's 2Africa subsea cable will run counterclockwise around the continent past the Cape of Good Hope, and link up back to European shores by 2024.

Stakeholders have an important role to play in ensuring that opportunities and investment do not go to waste. Organisations should invest in their employees by focusing on improving opportunity to learn and develop. It is also vital that businesses give back to their communities by investing in the upliftment of skills. A lack of skills lies at the heart of South Africa's high unemployment rate, and the government ends up spending a lot of resources on unemployment benefits at the expense of investment in skills development. The cost of upskilling or reskilling a population is far less than the cost of permanent social support. South Africa's social security system is among the most comprehensive and expansive in the world. Roughly 60% of all non-interest expenditure budgeted is allocated to housing development, free basic services, employment programmes, health, education and social grants.

President Cyril Ramaphosa has set up a new Broad-based Black Economic Empowerment (B-BBEE) Advisory Council, which has been tasked with generating new ways to improve representativeness in board and executive roles, create an equitable workforce, expand black skilled labour, and raise the overall participation of black people in South Africa's economy.

Google and Meta are investing in massive subsea cables, bringing internet infrastructure to millions across the continent

6. RWANDA

Vision 2050 is Rwanda's long-term development plan which captures the government's strategy to structurally transform the economy into a services-based, middle-income country by 2035, and a high-income country by 2050. The country is implementing its first National Strategy for Transformation (NST) programme, which runs from 2017-24. These programmes form the country's seven-year national strategies that the government uses to achieve its Vision 2050 goal. As noted in a government policy paper, more needs to be done to convert the country from an importer of ICT skilled manpower to exporter (MINICT, 2022). This will require investment in improving digital literacy and ICT skills in order to keep its citizens and businesses up to date with the changing global technological landscape. Failure to do so risks facing limitations in the advancement of its finance, tourism, education, agriculture, and health sectors and curtailing its goal of becoming a regional ICT hub.

NST aims to ensure digital literacy for all youth along with achieving digital literacy of at least 60% of adults by 2024

In the inaugural NST, one of the government's objectives under the economic transformation pillar is to establish Rwanda as a globally competitive knowledge-based economy. This encompasses ensuring the digital literacy of all youth (16 to 30 years) along with achieving digital literacy of at least 60% of adults by 2024. This translates into improving the digital skills of around five million Rwandans by 2024. Some initiatives aimed at improving digital literacy and skills include:

DIGITAL AMBASSADOR PROGRAMME

One programme the government is using to improve digital literacy and skills in the country is its Digital Ambassador Programme (DAP) led by the Ministry of ICT & Innovation (MINICT). The DAP's approach is based on the model of recruiting and providing digital literacy training to young women and men with entrepreneurship ambitions, with these individuals then acting as catalysts for change in their communities. Digital Ambassadors are recruited from young social innovators and are deployed in communities throughout the country in order to directly train citizens in accessing e-Government and other digital and mobile services through the Irembo Platform. By providing digital literacy training to members of their own communities, in local languages and by focusing on locally relevant digital content and services, DAP is expected to demonstrate the full value of the internet. By extension, it will also enable citizens and business owners to benefit from newly installed broadband connections in their areas and catalyse mass adoption of e-Government, e-Business, e-Agriculture, and mobile financial services.

In order to support the Digital Ambassadors in their role of training citizens on digital skills, the e-learning platform Atingi was introduced. On Atingi, young people and citizens in rural regions can access content on any device, anywhere and at any time. The courses cover a wide range of topics, such as vocational orientation, digital transformation, health, and entrepreneurship, all of which endeavour to increase employability and skills.

From September 2017 to June 2019, about 41,000 citizens were trained through a proof of concept. Since November 2019, the DAP has been fully implemented and approximately 68,000 individuals have been trained under the initiative.

SERVICE ACCESS POINTS

Under this programme, with funding from the World Bank, the government constructed 262 physical infrastructure facilities across 30 districts through which citizens can access public services online along with gaining basic ICT training. This was done with the goal of transforming rural communities into digitally literate and skilled citizens through various digital training programmes in addition to increasing access to internet services. The MINICT reports that since 2015, the programme has serviced on average 50 citizens per day with around 20 people receiving basic digital literacy training each day.

CONNECT RWANDA

Launched in 2019, the initiative challenges organisations in the public and private sector as well as individuals to donate smartphones to those who cannot afford them. The ConnectRwanda initiative is part of the government's goal of ensuring that every Rwandan household owns and uses a smartphone to access services and information. Smartphones have become a particularly important tool in rural farming communities through strengthening market linkages, minimising post-harvest losses by improving farmer-trader coordination, and through better delivery of extension and advisory services to farmers. One example of the impact of this initiative is the partnership between the MINICT, MTN Rwandacell (MTN Rwanda) and Rwanda Mountain Tea, to distribute 566 smartphones to tea farmers in western and southern provinces. Recipients of this initiative will be trained by MTN on handset usage, in addition to registering them to the network and setting up Mobile Money (MoMo) accounts, allowing them to use various MoMo services. Furthermore, the tea farmers will receive a 1 GB data bundle for free for three consecutive months, connecting them to the digital world. By the end of 2021, around 44,000 smartphones had been pledged for donation under the initiative.

ConnectRwanda is part of the government's goal of ensuring every Rwandan household owns and uses a smartphone to access services and information

WeCode

The programme is an initiative by the German government in collaboration with other institutions including the Ministry of Finance and Economic Planning (MINECOFIN), MINICT, ICT Chamber, GIZ Rwanda, Moringa School, and Muraho Tech to train Rwandan women in coding and software development. Over the programme's two phases, running from 2018-21, it has successfully trained over a hundred Rwandan women in software development, with some of the recipients finding employment in Rwandan companies such as MobiCash, Irembo, and GT Bank.

7. ZAMBIA

Digital financial education is playing an increasingly important role in the financial inclusion debate

Zambian Financial Sector Deepening Ltd (FSD Zambia), in collaboration with UK Aid, SIDA, Rural Finance Expansion Programme (RUFEP), and Jersey Overseas Aid, seeks to educate and support Zambians on affordable financial services and to broaden financial inclusion. Financial education (FE) is instrumental to financial inclusion, and through FE, consumer awareness and financial literacy development are broadened, according to the organisation. FSD Zambia defines FE as the process of introducing people to “the knowledge, skills, and attitudes required for responsible earning, spending, saving, borrowing, and investing”. Digital FE is playing an increasingly important role in the financial inclusion debate, and FSD Zambia has noted that the digitisation of education programmes has now become a key component of the skills development agency. This is partly due to the comparatively low cost, which can be facilitated through mobile learning (MLearning). Taking note of the rapid increase in mobile penetration rates in recent years, FSD Zambia introduced FE initiatives through mobile phones. In collaboration with the financial services provider Zazu, the mobile platform pilot programme in 2018 offered free access to FE courses through SMS, interactive voice response, or voice (English or Bemba). The pilot programme was much more successful than anticipated, which prompted FSD Zambia to explore opportunities for scaled-up digital FE. In 2017, FSD Zambia and learning platform Mwabu introduced a blended learning and certification programme which augmented in-person learning with virtual education.

In April 2022, the Ministry of Technology & Science released the Zambia Inclusive Digital Economy Status report 2022, which outlined strategies to increase the use of digital technologies. Utilising the UN Capital Development Fund’s (UNCDF) Inclusive Digital Economy Scorecard (IDES) tool, Zambia attained a digital economy score of 45, which means that the country is still in the start-up phase of digital economy. This aligned with the World Bank’s assessment that to enable Zambia to make greater use of digital technologies as a transformation tool, individuals, businesses, and government must have the requisite digital skills. While the 7NDP (Seventh National Development Plan, the cornerstone of policy) envisions ICT as a mainstream education point in schools – the national curriculum made ICT a compulsory project – in practice, digital skills education, and digital financial skills development in particular, has fallen behind target. The World Bank emphasised in 2020 that a digital transformation strategy is required to enhance private sector productivity and accountability across public and private sectors. The digital transformation agenda is connected to the country’s 2030 Vision, which incorporates Zambia’s ambition to become an information and knowledge-based society by 2030. Through digital financial skills developments, Zambia aims to reduce developmental inequality, enhance human development, diversify the economy and boost job creation, and reduce poverty & vulnerability. Zambia has posted remarkable growth in the ICT sector in recent years despite a shortage of skilled labour – the World Bank noted that this may be an indicator of the increased demand for programming skills. Within the digital enterprise segment, the largest category is digital financial services – a direct consequence of the rapid uptake of digital financial services. Among

the factors that authorities have identified as fostering an enabling environment for further growth in the segment is policy & legal framework reform, and technical skills & capacity. Focusing on the latter will unlock the diversification of the economy through the incubation of entrepreneurial talent and the provision of skilled labour to accelerate growth in the sector.

In a Working Paper (April 2022), the Brookings Institute and the Zambia Institute for Policy Analysis and Research (Zipar) identified economy-wide and industry-specific constraints which limit growth of priority sectors such as finance & business, agro-processing, transport, storage, ICT, and formal wholesale & retail trade. These barriers include labour market regulations and skills shortages. While Zambia has made progress towards improvements in the business climate and policy transparency, critical skills shortages in sectors such as ICT limit output growth. The Working Paper calls for a structural transformation which would contribute to employment creation and poverty reduction in accordance with the strategic Vision 2030 policy paper. The Brookings Institute and Zipar stress the timeliness surrounding the creation of “*productive employment for the country's expanding and youthful labour force*”, warning that the challenge of job creation “will only intensify in coming years”. Nearly half – 46% – of the population is below the age of 15, which portends an unemployment crisis unless adaptive job creation solutions or, more likely, human skills development, can bridge the gap between an under-skilled labour force and sectoral rotation towards skills-intensive industries. The weak transferability of skills across the sector spectrum is a key challenge in this regard: reduced employment opportunities within the primary sector (specifically low-skilled mining jobs) will not be absorbed by expansions within the skills-intensive secondary and tertiary sector. At the same time, the manufacturing sector is unable to absorb the labour force excess emanating from sectoral rotation from the primary sector.

Critical skills shortages in sectors such as ICT limit output growth

A CHANGING GLOBAL CONTEXT

These findings suggest that there is an immediate need for the incorporation of digital training and literacy in skills development

The need to improve human capital across the African continent is irrefutable. The overarching need to give this improvement a digital dimension is equally evident. This digitisation trend was accelerated by the COVID-19 pandemic. Lockdowns forced many businesses to rethink their digital strategies while remote working became the norm in services sectors across the globe. In fact, a senior executive survey by Cognizant (Cognizant, 2021) finds that nearly half of respondents (49%) expect the pandemic to destroy traditional, non-digital businesses and those that do not reposition themselves online aggressively enough. A similar percentage (46%) anticipate less personal interaction with customers, and well over one-third (37%) say they will need to rely on digital channels for customer engagement.

These findings suggest that there is an immediate need for the incorporation of digital training and literacy in skills development. In addition to increased digitisation, a number of underlying trends will have a direct bearing on the nature of future skills demand and the availability of supply. This section examines four salient trends that will shape the future labour force, namely labour migration, digital infrastructure, digitisation & 4IR, and climate change.

MIGRATION AND BRAIN DRAIN/GAIN

THE LOSS OF TALENT

Migration per se is the most human of activities: the reason there are people living in every inhabitable place on Earth is the consequence of the human drive to find a better place to live. The label of brain drain is applied when it is the case that the emigrant stock leaving a country is overwhelmingly better qualified than the overall population, which has the consequence of gradually reducing expertise in a population. Policymakers and experts have long been concerned about Africa's brain drain – the skills lost to the continent as its sons and daughters leave its shores in search of better lives overseas. In 2018, the African Union estimated that 70,000 skilled professionals were emigrating from Africa every year, seeking better professional opportunities. The pernicious effects of the brain drain are many. Most obviously, the African countries of origin are left without precious skills, and must wait longer, or even look abroad themselves, for the services that their emigrant compatriots had provided. Source countries also suffer a shrinkage of their tax base.

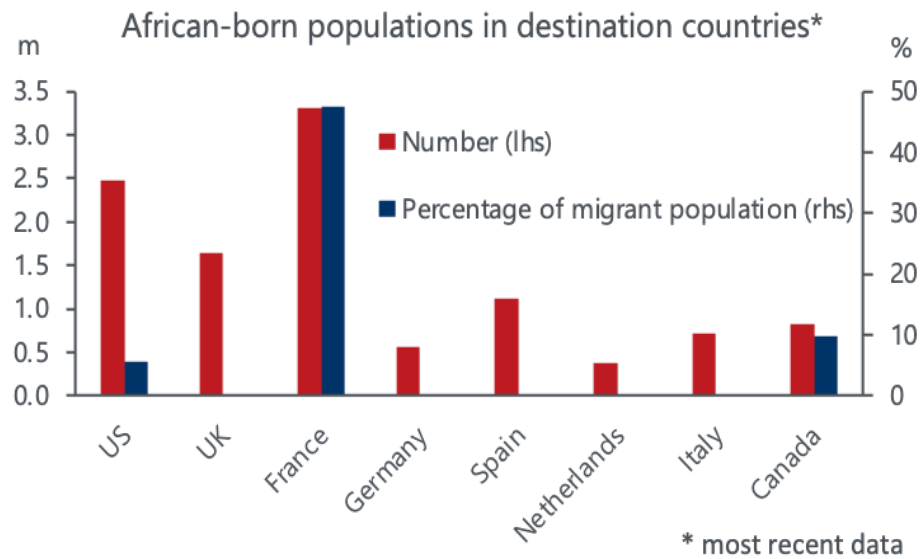
Migration leaves the African countries of origin without precious skills

Occasionally, an African administrator will provide a statistic that reveals the magnitude of the problem. As of February 2022, 1,200 Algerian doctors were qualified to practice in France – a country that was already home to more than 4,400 doctors who had obtained their qualifications in Algeria in 2017. A study carried out in Tunisia in 2020 found that in the previous five years, 39,000 engineers and 3,300 doctors had emigrated and that a third of emigrants had a higher education degree. In April this year, the Nigerian Medical Association said more than 9,000 doctors had left the country over 2016-18. In April, Morocco's National Council for Human Rights said that "almost one in three" Moroccan doctors practice abroad. Egyptian officials, too, are concerned about the scale of emigration by doctors, saying that 11,500 physicians in the public service resigned, either to go into private practice or, more probably, to emigrate, from January 2019 to March 2020.

AFRICANS ABROAD

The magnitude of the issue is extremely hard to quantify, largely because of the paucity of data collected by African governments. Most African migrants reside in other countries on the continent, whether with the aim of settling there or with the objective of eventually moving on to a more advanced economy, but the numbers of these migrants are not known. To give an idea of migration in this research, therefore, it has been necessary to rely on the statistics collected by agencies in developed countries that host African emigrants. The Mo Ibrahim Foundation estimates that in 2013, France, the UK, and the US hosted about 50% of the total sub-Saharan African diaspora. We have considered the statistics from these countries' agencies along with other important destinations in the EU – Germany, Spain, the Netherlands, and Italy – as well as Canada.

The number of African migrants to France has been growing steadily over the past decade and a half – as has the proportion of total immigration that the flow of people



Source: National statistics agencies, 2022

Migrant populations are considerably better educated than the typical profiles of the societies from which they come

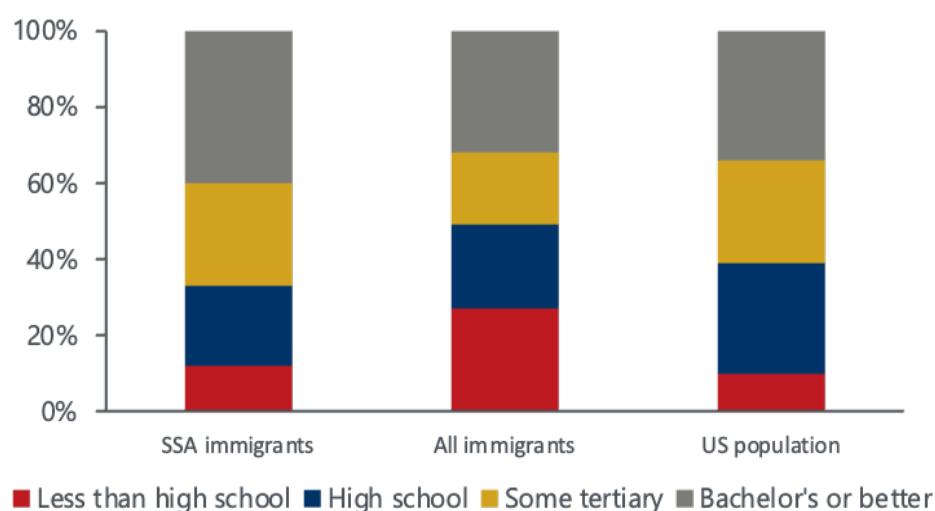
from Africa represents. In 2020, 3.2 million Africans made the trip to France (up from 2.3 million in 2010), and they accounted for 63.2% of all migrant arrivals (up from 46.0% a decade earlier).

WHO IS THE DIASPORA?

The above statistics show overall migration. A discussion of brain drain, however, is not only about migration: it is about the migration of skilled professionals. So, to what degree are African diaspora populations made up of the exceptionally well-educated? As one would expect, given that receiving countries always manage migration on a points-based system in which educated migrants are more welcome, migrant populations are considerably better educated than the typical profiles of the societies from which they come. (In 2016, in fact, the proportion of foreign-born adults in the UK with a university degree was larger than that of the native British population; though, that is unusual – the same was not true in other major EU countries.) In 2018, 32% of immigrant adults living in the US had a bachelor's degree or higher; 17% of all college-educated adults in the US were born abroad.

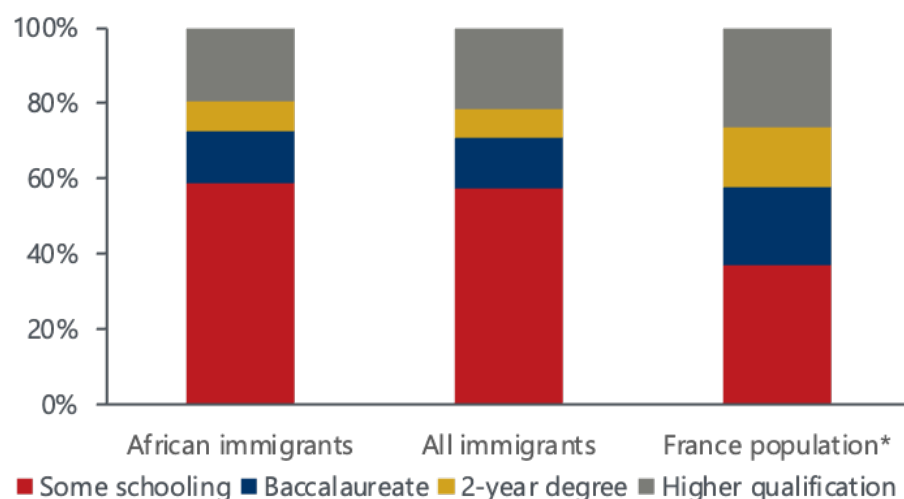
Unfortunately, data constraints limited the degree to which it is possible to properly compare Africa's diaspora in different host countries in terms of educational attainment. The British government does not maintain useful data, while Eurostat does have numbers for the overall migrant population, but they are not broken down by region of birth. The US and France have useful data, but those records are not directly comparable because of the way in which the two countries' own education systems differ. However, the data does clearly show that the African-born population of those two countries is well educated by any measure. In the US, 40% of immigrants from Africa excluding North Africa hold a bachelor's degree or better, compared to 32% of all foreign-born residents and relative to 34% of the overall population. In France, over a quarter of African immigrants have a tertiary qualification. While that is lower than the numbers for all immigrants in France as well as for the general population, it is still a very respectable level of education.

Education levels, US



Source: Pew Research Institute, 2018

Education levels, France



*Men aged 25-44

Source: National Institute of Statistics and Economic Studies, 2019

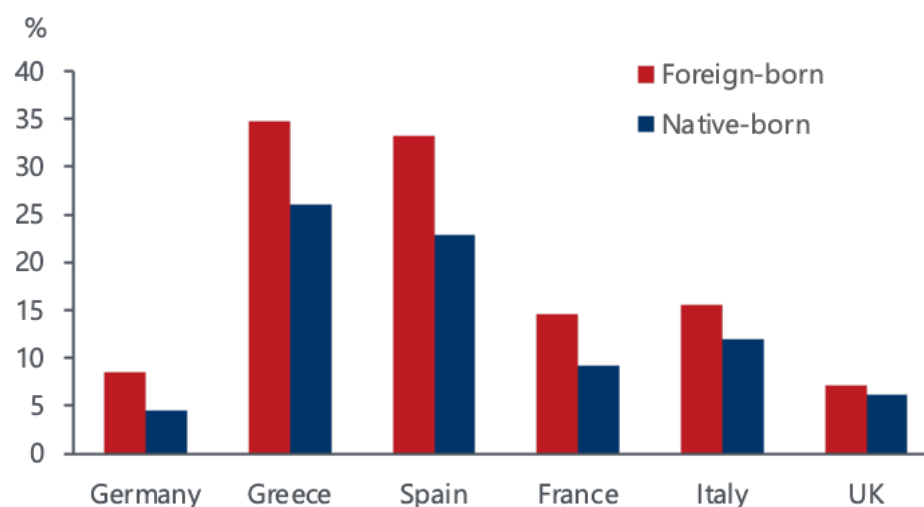
The African-born population of the US and France is well educated by any measure

UNEMPLOYMENT AND BRAIN WASTE

Unemployment rates tend to be higher for immigrants, and sometimes substantially so. In the EU in 2014, for instance, the unemployment rate for foreign-born residents of Belgium was 17%, compared to 7% for native-born residents. In Spain it was 33%, compared to 23%, and in France it was 15% compared to 9%. At the end of March 2022, the unemployment rate for non-EU nationals resident in the UK was 7.5%, compared to 3.3% for EU nationals and 3.4% for UK nationals.

In addition to outright unemployment, there is the issue of migrants often having to resort to doing work for which they are overqualified – a phenomenon which US authorities have coined the evocative phrase ‘brain waste’. Using as a metric the number of workers having completed tertiary education but employed in low- or medium-skilled jobs, in 2011, the EU estimated that the overqualification rate of foreign-born workers aged 20-64 was higher than the rate in the general population: 33% to 21%. The Migration Observatory at the University of Oxford notes that “migrants are more likely to work in jobs

Unemployment rates, 2014



Source: Eurostat

Migrants often have to resort to doing work for which they are overqualified

for which they are overqualified, especially if they have foreign qualifications". In the UK, the most recent estimate of the overqualification rate (from 2020) among immigrants is 27%, and it is slightly higher for immigrants from sub-Saharan Africa: 33%.

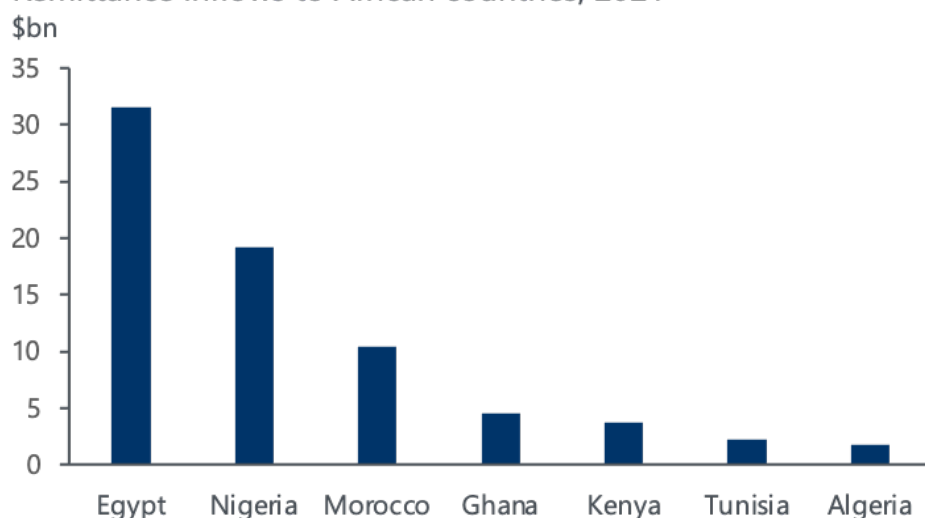
In the US, the Migration Policy Institute found in 2021 that the underemployment rate among college-educated immigrants was 21%, compared to 16% in the overall population with the same level of education. This is a logical consequence of the fact cited above – that immigrants to the US are better qualified than the native-born population – as well as of the fact that the variation has been growing, meaning that every year, the flow of immigrants is better educated than the year before. From 2010 to 2019, the college-educated immigrant population of the US increased by 42%, whereas the share of college educated people in the overall population increased by 27%.

From the above, two conclusions are apparent. The first is that brain drain is real: African emigrants are disproportionately well educated, and so their emigration is a net loss to the continent because of the skills they take with them. The second conclusion is that data collection on the continent needs to improve substantially, so that a more comprehensive picture may be obtained not only of the brain drain of net emigration from Africa, but also of the brain gain for countries that receive migrants from elsewhere on the continent.

REMITTANCES

The positive side to brain drain is the compensation that source countries receive for the skills lost: cash transfers in the form of remittances that expatriates send home. After the shock of COVID-19 in 2020, remittances bounced back in 2021. The World Bank estimates that remittance flows to low- and middle-income countries increased by 8.6% last year, as expatriates sought to alleviate the economic stresses endured by their families back home, and also since it has a positive effect on a host country's economy because of the stimulus measures that a government implemented.

Remittance inflows to African countries, 2021



Source: World Bank

Growth in remittance income in 2021 was remarkable in a few countries: 60% in Tanzania, 40% in Morocco, 20% in Kenya. Spotty reporting may explain part of the jump, but the significant amounts repatriated show how beneficial the brain drain is for many African economies. The \$19.5bn that Nigeria received in remittance inflows in 2021, for instance, is almost four times bigger than its current account surplus of \$5.0bn that year – that is, Nigeria would have recorded a current account deficit if remittances had been lower by just 27%. In Morocco, the \$10.4bn received in remittances compares to a current account deficit of \$3.1bn. The effect on the economy is even more pronounced in small countries. In The Gambia, remittances are equal to 27% of GDP; in Lesotho the figure is 23%.

Remittances play a critical role in a number of African economies

An issue for emigrants from Africa is that it is the region of the world to which it is the most expensive to send remittances: the World Bank estimated in May this year that the average cost of a money transfer to the region in Q4 2021 was 7.8% of the sent amount, compared to a global average of 6.0%.

Remittance flows to Morocco increased by 40% from 2020 to 2021. Part of the explanation is the economic recovery in countries that host large numbers of Moroccan expatriates, like France and Spain, but another part of the explanation merits mention and sheds light on the phenomenon of intra-African migration. That explanation is transit migration: many Africans seeking to migrate to Europe first stop in Morocco, and during their stay there receive remittances from their families. That is, these migrants are receiving outflows from their home countries; not sending money back to them. If attempts to cross the Mediterranean stay at their current high levels, or even increase because of land degradation and increased conflict, this problem will continue to exacerbate the issue of brain drain for the poorest countries in Africa.

AFRICAN CONTINENTAL FREE TRADE AGREEMENT

The idea that Africans should be free in their movements across their continent has a long history in African diplomacy. In 1991, the Abuja Treaty establishing the African Economic Community (AEC) contained a commitment to “adopt ... the necessary

measures in order to achieve progressively the free movement of persons, and ... the right of residence" of member states' nationals within the Community. In 2018, the AU, successor to the AEC, adopted a protocol "relating to the movement of persons, right of residence and right of establishment", with the objective to realise the aims of the 1991 treaty by giving Africans the right to enter other member states visa-free and to stay for 90 days, and then to encourage member state parties to "gradually implement favourable policies and laws on residence" and to promote the right of establishment of a business or profession. This protocol was signed by state parties in March 2018, at the same session that adopted the African Continental Free Trade Agreement (AfCFTA).

There has been some progress in pursuit of freer movement of people

Four years later, there has been some progress in pursuit of freer movement of people. In 2019 the African Development Bank announced that, for the first time, thanks to policies implemented in the preceding three years, more than half of African countries allowed visa-free entry or the purchase of a visa on arrival to African citizens. Nigeria subsequently introduced a visa on arrival for African nationals.

Residence- and work permits remain difficult to obtain in African countries that are popular destinations for emigrants, such as Morocco and South Africa. Governments remain protectionist in their inclinations, and slow to change the rules. Furthermore, even visa-free travel remains limited to Africans who have passports, and passport issuance in many countries is bedevilled by administrative problems and, sometimes, high costs: in 2020, a passport in the Democratic Republic of Congo (DRC) cost \$185.

DIGITAL INFRASTRUCTURE

Digital infrastructure, in its broad sense, comprises the physical and non-physical resources required for the use of data, computer-based devices, systems and processes (Atkinson et al., 2016). The components of digital infrastructure include the internet of things (IoT), end-user devices (computers, phones), data centres, the cloud, and software applications.

Africa has seen significant growth in its digital infrastructure over the past decade, but the digital divide on the continent remains stark: less than one-third of the African population has access to broadband connectivity (World Bank, 2022b), while approximately 300 million Africans live more than 50 km away from a fibre or cable connection. At just 36%, Africa's internet penetration compares poorly with the 62.5% global average (Statista, 2022). Also, of the 25 least-connected countries in the world, 21 are located in Africa (World Bank, 2021c).

One of the main obstacles to bridging this digital gap is a lack of investment. The World Bank states that achieving universal, good-quality internet access in Africa will require investments of \$100bn – 80% of which is needed for core infrastructure to build and maintain broadband networks (World Bank, 2019). To date, the majority of digital infrastructure projects in Africa have been funded through equity investments – a consortium of partners that include Meta, MTN, Vodafone, and Orange are bankrolling the 2Africa cable, while Google and its co-investors are funding the Equiano subsea cable project. Meanwhile, the IFC has invested \$250m into Liquid Intelligent Technologies, also known as Liquid, through equity and debt. Limited recourse or non-recourse funding has yet to be seen on a larger scale. Nonetheless, as the need for digital infrastructure grows, structured financing solutions are expected to increase. The high costs of constructing and operating mega-data centres should also encourage a shift towards alternative funding sources that efficiently deploy capital.

There are ongoing initiatives to accelerate digital investment in Africa, including the new EU-AU Digital4Development hub, which aims to foster partnerships and investment in the African digital economy. Likewise, the AU Programme for Infrastructure Development in Africa also focuses on regional infrastructure projects, while Smart Africa, an initiative of African Heads of State, promotes harmonised regulation across countries. Some key investment trends involve the following:

Fibre-optic cables: Only three African countries – the Central African Republic, Eritrea, and South Sudan – lack the fibre-optic connection to the submarine cables that circle the continent. By some estimates, African countries have rolled out more than 1.389 million km of terrestrial fibre links, of which around 936,000km was already operational in 2018 (Broadband Commission, 2019). The 2Africa Cable system – the largest subsea project, which will ring the entire African continent with a 37,015-km-long, high-speed subsea cable – is expected to include 21 landings in a total of 16 African nations and

Africa has seen notable growth in its digital infrastructure over the past decade, but the digital divide on the continent remains stark

double the continent's internet capacity, once completed in 2024 (Digital Council Africa, 2021). The Equiano project will extend along the continent's Atlantic coastline with landing points in Nigeria, Namibia, and South Africa. The first phase of the project that connects South Africa and Portugal is expected to be completed this year (Submarine Cable Networks, 2022).

Fibre-optic networks have yet to fully penetrate Africa's inland countries. More specifically, the nationwide availability of high-speed internet (broadband) via fibre-optic connections to homes and offices remains sparse and largely concentrated in a few capital cities (African Union, 2020). For example, the penetration of fibre-based broadband services in African households outside of North Africa is below 2%, while South Africa's fibre-based broadband subscriptions account for nearly half of all fibre-based broadband subscriptions in the region. All in all, the global fibre-optic submarine telecommunication cable systems market, valued at \$23.4bn in 2020, is forecast to grow by 7.1% per year and reach \$37.8bn by 2027 (Digital Council Africa, 2021).

Africa accounts for just 1% of the world's data centre capacity

Data centres: Africa accounts for a mere 1% of the world's data centre capacity (Infrastructure Investor, 2021). According to the African Data Centres Association, roughly two-thirds of that capacity is located in South Africa. To bring the rest of Africa up to a similar density to South Africa, the continent would require roughly 700 new data centres collectively drawing on 1,000 MW capacity (Infrastructure Investor, 2021). Between 2020 and 2021, four major pan-continental deals and investment commitments worth \$2.0bn were concluded. These involved Equinix's purchase of Main One (\$320m), West Indian Ocean Cable Company's (WIOCC) investment in Open Access Data Centres (\$500m), Digital Realty's investment commitment to Africa (\$500m), and Liquid's \$500m investment into Africa Data Centres (ADC). Additionally, ADC received a \$300m handout from the US International Development Finance Corporation (DFC) in 2020 to acquire and expand data centres and enter new markets. As a result, ADC has opened a new facility in South Africa and is constructing others in Nigeria, Togo, and Kenya. The organisation also plans to build 10 data centres in 10 African countries over the next two years (BIZTECH Africa, 2020). Meanwhile, Liquid has received \$259m worth of investment from the IFC to expand its data centre capacity and roll out fibre-optic cables in Africa (IFC, 2021). It is worth noting that local African businesses, including Vodacom/Safaricom, MTN, Rack Centre Nigeria, ADC, and Teraco, own more than 95% of Africa's data centre capacity. With that being said, international investors in hyperscalers have started entering the market in recent years. Looking ahead, Africa's data centre market is expected to grow to \$3.0bn by 2025 (Globe News Wire, 2020).

Mobile networks: Mobile technology remains the leading method of connectivity for the majority of the African population and has been the most widely adopted on the continent. In 2021, there were approximately 930 million mobile service subscriptions with an 83% penetration rate against the population in Africa (excluding North Africa). However, it should be noted that unique subscriptions were still slightly below 50%, and mobile internet subscriptions stood at 340 million, which means only 30% of the African population outside of North Africa could use internet services in that year. Stated differently, Africa was way behind the global average of 55% mobile internet penetration (Digital Council Africa, 2021). In 2020, 4G accounted for only 12% of mobile connections on the continent, and only seven commercial 5G networks had been established in five African markets by 2021 (GSMA, 2021). On a more positive note, average download speeds in Africa doubled between 2015 and 2019, while data costs were halved (Infrastructure Investor, 2021). Africa's mobile penetration could reach 50% by 2025 (more than 600 million connections, 65% via smartphones). Mobile devices will likely remain the primary method of internet access for people in Africa going forward. Better 4G and 5G networks serving these devices would provide greater bandwidth, lower latency, improve spectrum efficiency, and bring innovative IoT products and services to Africa.

Mobile devices will remain the primary method of internet access in Africa

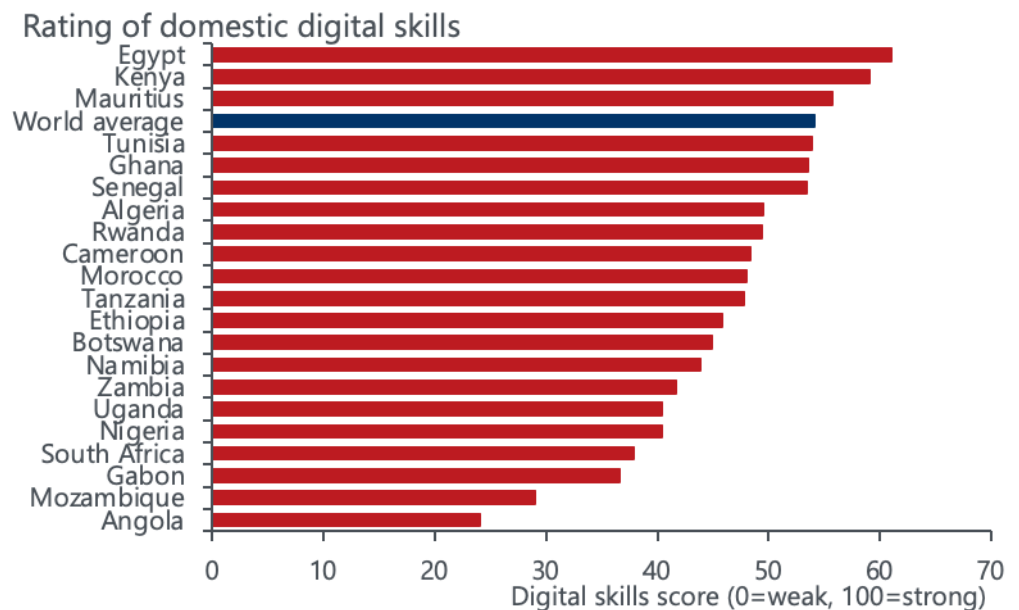
DIGITISATION AND 4IR

The United Nations Commission on Science and Technology Development states that digital skills, sometimes also called digital competencies, encompass the “*knowledge and skills required for an individual to be able to use ICTs to accomplish goals in his or her personal and professional life*” (International Telecommunication Union, 2022: 3). While one might immediately associate digital skills with technical skills required by people who “*engage with a wide variety of digital technologies: desktops, laptops, mobile phones and other Internet-enabled or ‘smart’ devices*”, they also include cognitive and non-cognitive soft skills such as interpersonal skills and communication skills.

Highly specialist knowledge is usually transferred through advanced formal education

Digital skills are typically classified into three levels – basic, intermediate, and advanced – and these skills are seen as being on a continuum where continuous learning facilitates a shift from basic digital skill levels towards intermediate and advanced skill levels (International Telecommunication Union, 2022: 4). Basic digital skills refer to the rudimentary handling of digital devices, accessories, apps, web search, and online transactions, while intermediate skills refer to specific skills required at an occupational level, such as operating software and data management platforms. Advanced skills, meanwhile, are “*highly specialised*” and are required in occupations such as computer programming, software development, data science, and network management.

While basic, intermediate, and advanced skills can all be attained through some form of self-study, peer education, and formal education, highly specialist knowledge is usually transferred through advanced formal education, boot camps, and online training (International Telecommunication Union, 2022: 5). As the fourth wave of industrialisation unfolds across the globe, the need for digital skills at different points along the continuum



Source: World Bank, 2022

is becoming even more pressing. From shop assistant to software developer, a certain level of digital fluency and ICT literacy is becoming essential to most occupations. The COVID-19 pandemic has also fast-tracked this shift and exacerbated demand for digital solutions and competencies, further shining a light on the digital skills shortage or 'gap'.

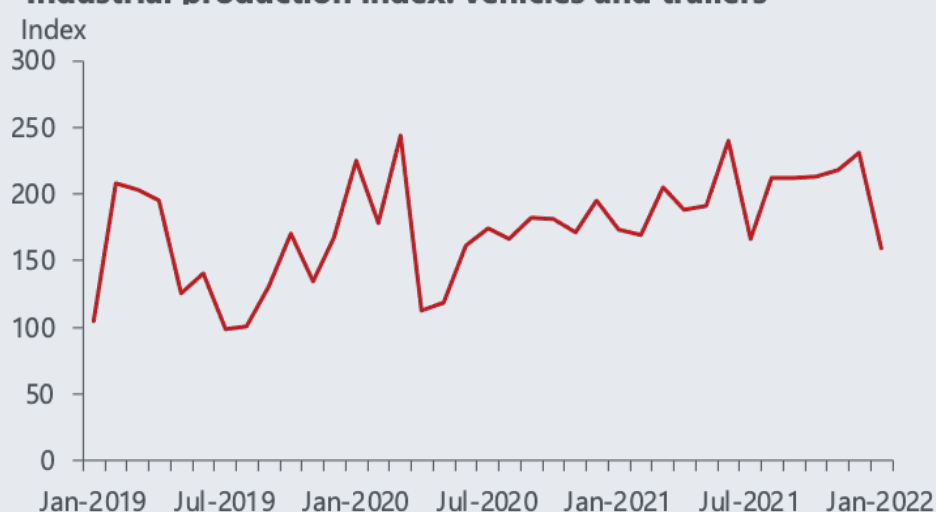
The graph above shows that most African countries score poorly in terms of digital skills when compared with the rest of the world. A low level of digital skills across the African population contributes towards a growing skills mismatch, as employers struggle to find digitally skilled talent. The digital skills gap continues to widen given the increasingly important role that technology plays in various sectors, such as

Most African countries score poorly in terms of digital skills when compared with the rest of the world

CASE STUDY: A DOMESTIC EV MARKET IN EGYPT

In recognition of the need to decarbonise the domestic transport sector while also recognising the potential benefits to the domestic manufacturing industry, the Egyptian government is lending its support to the locally manufactured electric vehicles (EVs). In June 2021, the Ministry of the Public Business Sector launched the Nasr E70 electric car after an initial agreement with Dong Feng Motor Corporation in China. Egyptian authorities and the company were unable to reach an agreement on the way forward following initial testing, but the initiative is reportedly back on track. The Egyptian government is yet to announce its partner in producing the nation's first domestically produced electric vehicle, but its intention to jumpstart the sector remain clear. Authorities have already announced the implementation of financial incentives for consumer to switch to EVs: a package of incentives for electric cars has been developed, including a subsidy of E 50,000 for the first 100,000 buyers. Meanwhile, 10 companies and consortia have reportedly qualified to tender for the management and operation of electric car charging stations. The winning bidder is scheduled to establish and operate 3,000 charging stations for electric cars within 18 months in the governorates of Cairo, Giza, Alexandria, and Sharm El-Sheikh and on various highways.

Industrial production index: vehicles and trailers



Source: Haver Analytics, CAPMAS

Domestic vehicle production in Egypt has been volatile and, given a weighting of just 1.9%, does not represent a major manufacturing subsector. Efforts to develop domestic EV production capacity will have significant implications for skills development. The necessary skills required to produce EVs will continue to evolve, and to produce a competitiveness and robust domestic sector the government will have to ensure that there is an adequate supply of the necessary skills in the labour market.

agriculture, manufacturing, and services. In fact, a study by the IFC estimates that more than 230 million jobs in Africa (excluding North Africa) will require digital skills by 2030 (International Finance Corporation, 2019: 51). It is against this backdrop that public and private sector stakeholders need to prioritise education and training to ensure that the workforce keeps up with the fast-changing future trajectory of jobs.

As the 4IR takes hold and spreads across the globe, all countries will have to adapt to a new economic reality. This new reality will take the form of fundamental changes to economic structures, and the emergence of new economic sectors at the expense of some traditional sectors. This will of course have a direct bearing on skill demands, as modern sectors will require modern skills. Major trends that will require structural changes include the global transition towards greener energy, the proliferation of automation and the implications thereof for onshoring of manufacturing activities, and the increased prevalence of remote working.

CLIMATE CHANGE

Climate change has already begun to take its toll in Africa. The average temperature is rising, and extreme weather events are more intense and frequent (IPCC). In the decades to come, it will have a direct impact on education and skills development, as well as the demand for digital skills on the continent. High-tech digital devices and platforms are increasingly being deployed to enhance productivity, efficiency and sustainability, and in-depth research shows that digitisation could serve as an enabler of climate change adaptation (Balogun et al.).

An estimated 53% of Africa's population outside of North Africa is employed in agriculture – this percentage is a lot lower (15%) for MENA. However, the agricultural industry is among the most vulnerable to climate change-induced weather conditions such as rising surface temperatures, extreme weather events, and shifting weather patterns (Kogo). There is also a possibility of immense flooding as the sea-level is projected to rise. Farmers in Africa are particularly vulnerable due to the predominance of rainfed agriculture and pastured livestock systems, and many countries' economic well-being is dependent on climate sensitive crops, such as tea and coffee. While the impact of climate change on agriculture is vast, it should also be acknowledged that the industry is part of the climate problem. It is responsible for up to a third of total greenhouse gas emission and food waste is a major issue, which has contributed to growing global sentiment towards pushing farmers to make use of more environmentally friendly and efficient production techniques to reduce its impact on the environment. These factors are contributing to the growing need for farmers to make use of digital technologies to become more climate resilient, while still meeting the food needs of the continent's growing population.

Going forward, digital technology adoption could shelter the agricultural industry from the negative impacts of climate change. In addition to improving farming techniques, digitisation could also rapidly improve farm management systems and value chains, while minimising crop and livestock loss due to extreme weather events. To avoid a grave loss of livelihood for those who rely on the industry for sustenance, as well as ensure food security on the continent, it is necessary that farmers and herders acquire digital skills and have access to technology that will enable them to effectively adapt to climate change. The central necessity of digitisation and the use of technology in climate resilience efforts are expected to change the agriculture and food sector (Poppe et al.).

Climate change is expected to continue to push demand higher for more technologically advanced skills from farmers, but a lack of access to education in Africa will persist as a major barrier to adopting digitized agricultural technologies. Therefore, it is necessary that pressure to transition towards a more climate-friendly economy, which includes the agricultural industry, is accompanied by efforts to transfer knowledge about the available farming technologies and how best to use them. If farmers do not acquire the

An estimated 53% of Sub-Saharan Africa's population is employed in agriculture

necessary digital skills to adapt to climate change, the inability to sustain themselves in the agricultural industry may lead them to seek employment in alternative industries.

One of the ways that farmers and herders can adapt to the change in weather conditions is by implementing climate-smart agriculture (CSA). This involves an integrated approach to managing landscapes that address the interlinked challenges of food security and climate change. The World Bank's CSA programmes are based on existing knowledge, technologies and principles of sustainable agriculture. It includes enabling farmers to transform their agricultural techniques to adapt to changing weather patterns as well as using advanced technology and data analysis to forecast when to expect the ideal weather conditions for their crops. CSA programmes are aimed at ensuring development, resilience and growth of the agricultural industry. With extremely limited arable land in Kenya, farmers are embracing new and improved technologies in dairy and horticulture production systems. The World Bank CSA Project in the country is aimed at building resilience to climate-change risks in smallholder farming and pastoral communities, while the newer National Agricultural Value Chain Development Project (NAVCDP) is focused on increasing market participation and value addition by farmers. These projects involve the implementation of digital agriculture initiatives, irrigation management and the development of safer urban food systems. The CSA has had more than 500,000 beneficiaries in Kenya since its inception in 2016. The World Bank also supports other CSA-based projects in Africa, including in Senegal, Nigeria and Mozambique.

Climate change is expected to continue to push demand higher for more technologically advanced skills from farmers

CONCLUSION

Mastering the appropriate skills will become increasingly important as the global economy evolves to a more sophisticated, interconnected and digital landscape. Africa currently underperforms on a number of human capital measures, and runs the risk of falling further behind if decisive and effective action is not taken. A low-level of digital skills across the African population contributes towards a growing skills mismatch, as employers struggle to find digitally skilled talent. The digital skills gap also continues to grow as technology plays an increasingly important role in various sectors, such as agriculture, manufacturing, and services.

Technological advances hold significant potential to improve the livelihoods of millions. However, those empowered with the skills required to leverage this technology will see the benefits, while those unable to adapt to the new landscape could be left worse off. To ensure that Africa benefits from these global developments, African governments have to follow a two-pronged approach: putting in place the education and training facilities to ensure that the ability to acquire digital and vocational skills is widespread, and secondly, ensure that the policy and infrastructure (both hard and soft) allows for the development of economic sectors of the future. This means being open to more adaptive, and private sector-led provision of skills development, and effective spending on the most necessary digital infrastructure. Africa has seen significant growth in its digital infrastructure over the past decade, but the digital divide on the continent remains stark.

There are a number of underlying trends that Africa will have to contend with in pursuing the development of a highly skilled workforce. The pernicious effects of the 'brain drain' remains a problem, with the African countries of origin being left without precious skills, and must wait longer, or even look abroad themselves, for the services that their emigrant compatriots had provided. In turn, as the 4IR takes hold and spreads across the globe, all countries will have to adapt to a new economic reality. This new reality will take the form of fundamental changes to economic structures, and the emergence of new economic sectors at the expense of some traditional sectors. Finally, the impact of climate change as well as global efforts to combat it will have a marked impact on salient sectors such as agriculture, which will remain central to African economic development for the foreseeable future.

To ensure that Africa benefits from these global developments, African governments have to follow a two-pronged approach

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