INTERSESSIONAL PANEL OF THE UNITED NATIONS COMMISSION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT (CSTD)

Lisbon, Portugal
6-7 November 2023

Contribution by South Africa

to the CSTD 2023-2024 priority theme on "Data for Development"

PRIORITY THEME 1: Data for Development

United Nations Commission on Science and Technology for Development (CSTD)

Dear CSTD Member,

The 26th CSTD annual session selected "Data for Development", as one of the priority themes for its 27th session (2023-24 period).

Data, including for scientific and research purposes, are becoming a key strategic resource for sustainable development. If well managed, data can help overcome major global development challenges, such as poverty, food security, climate change, disaster risk management, and pandemics. If badly handled, they can generate unequal development outcomes. General Assembly's resolution 77/150 of 14 December 2022 noted that the Commission on Science and Technology for Development could explore the connection between data and sustainable development, including data governance, while taking into account the multiple dimensions of data. The development implications of data, including data quality, data capabilities, and responsible data handling should also feature prominently in discussions about the Global Digital Compact and in the Summit of the Future, adding to the relevance of the CSTD's perspectives on this issue as the UN focal point for STI for development.

Under this theme, the Commission will consider issues such as major contributions and risks of data in relation to the achievement of the 2030 Agenda for Sustainable Development; how to ensure that developing countries benefit from the data revolution while considering risks; national and international policies and support measures that can help address the challenges of the developing countries in the area of data relevant for sustainable development, while taking into account the multiple dimensions of data.

The CSTD secretariat is in the process of drafting an issues paper on the theme to be presented at the CSTD inter-sessional panel meeting to be held in the second half of October 2023 in Portugal. In this context, we would like to solicit inputs from the CSTD member States on this theme. We would be grateful if you could kindly answer the following questions based on your experience in your country or region.

1. What are the major contributions and risks of data in relation to the achievement of the 2030 Agenda for Sustainable Development?

   South Africa is one of the digital economy leaders on the African continent, but lags developed countries. In this context, the digital economy for Africa targets appear within reach for South Africa, although efforts need to be maintained. Launched in 2018 through a collaboration between the African Union (AU) and the World Bank, the digital economy for Africa initiative aims to ensure that every individual, business, and government in Africa will be digitally enabled by 2030. South Africa can also play a leading role for regional digital development, particularly within the context of the recently signed continental free trade area (CFTA) agreement, as well closer to home in the Southern Africa development community (SADC) and common market for Eastern and Southern Africa (COMESA) context, following on the East Africa single digital market as an example. South Africa can assist by leading the agenda to harmonize customs, disseminating best practices to other countries around issues such as data regulation, improvement in the ecommerce environment, promotion of Africa wide payment systems, and the provision of an even stronger regional hub for tech entrepreneurs. In this context, the South African government is aiming to pass several reforms across core elements of the digital economy, recognizing the need for new policy directions and preparing for the fourth industrial revolution (4iR). While South Africa's wealthy households have broad access to quality and relatively affordable internet, people earning less than South African rand (ZAR) 7000 a month are largely unconnected. This report reviews how the digital divide affects the foundations of the digital economy and provides policy options for bridging the divide. This report will provide a diagnostic and offer recommendations on the five foundations of the digital economy in South

Africa. The report will examine challenges concerning digital infrastructure, public digital government platforms, digital financial services, digital entrepreneurship, and digital skills.

Please the world bank report attached on digital diagnosis (Attached)
https://c4ir.co.za/
Report of the Presidential Commission on 4IR
https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf
National digital and future skills strategy of South Africa (Attached)

2. How can developing countries benefit from the data revolution while considering risks?

   Please the world bank report attached on digital diagnosis.
   https://c4ir.co.za/
   Report of the Presidential Commission on 4IR
   https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf
   National digital and future skills strategy of South Africa (Attached)

3. What national and international policies and support measures can help address the challenges of the developing countries in the area of data relevant for sustainable development, including scientific and research purposes, data quality, data capabilities and data governance, while taking into account the multiple dimensions of data?

   Please the world bank report attached on digital diagnosis.
   https://c4ir.co.za/
   Report of the Presidential Commission on 4IR
   https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf
   National digital and future skills strategy of South Africa (Attached)

4. In your country's view, what role could CSTD play in respect of data for development, including in the context of the Global Digital Compact?

   Please the world bank report attached on digital diagnosis.
   https://c4ir.co.za/
   Report of the Presidential Commission on 4IR
   https://www.gov.za/sites/default/files/gcis_document/202010/43834gen591.pdf
   National digital and future skills strategy of South Africa (Attached)

Please indicate contact person(s) responsible for projects/policies and international collaboration in this context in case we need clarification on the inputs.

Please send your responses and any further inputs on the theme to the CSTD secretariat (stdev@unctad.org) by **15 August 2023**. We look forward to receiving your valuable inputs.

Sincere regards,

CSTD secretariat

South Africa

Digital Economy Diagnostic

December 2019

WORLD BANK GROUP

THE WORLD BANK
IBRD · IDA

IFC International Finance Corporation

DE4
Digital Economy for Africa

TABLE OF CONTENTS

LIST OF FIGURES

This assessment of South Africa's digital economy development has been launched as part of the World Bank Group's (WBG) Digital Economy for Africa Initiative (DE4A), launched in 2018 through a collaboration between the African Union and the World Bank Group. The initiative aims to ensure that every individual, business and government in Africa will be digitally enabled by 2030. The related diagnostic framework is based on a standardized methodology focused on five key foundations. In South Africa, the DE4A builds on the ICT deep dive carried out in the WBG Country Private Sector Diagnostic, the results of the advisory work on ICT regulation by the WBG competition team, and the next steps agreed between the WBG and government at the Digital Economy workshop held in Pretoria in November 2018. The assessment maps the strengths and weaknesses that characterize the national digital economy ecosystem (See Figure 1) and identifies challenges and opportunities for future growth.

Figure 1: Five key foundations of the digital economy ecosystem
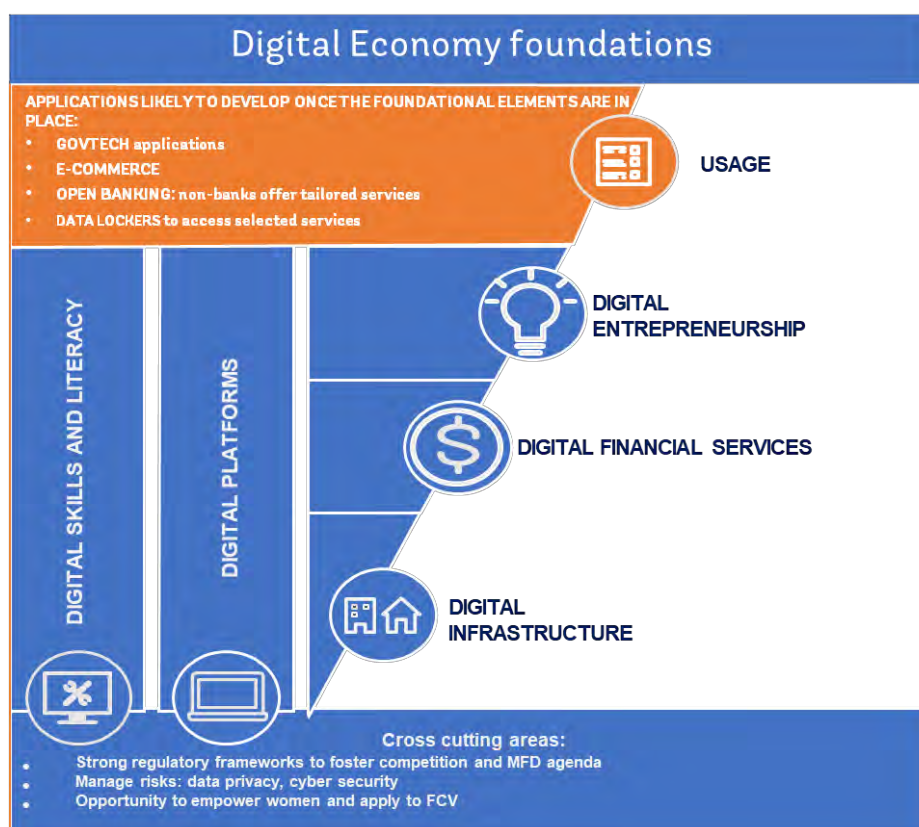
The digital transformation is reshaping our global economy, permeating every sector and aspect of daily life – changing the way we learn, work, trade, socialize, access public and private services and information (Figure 2). In 2016, the global digital economy was worth some $11.5 trillion – equivalent to 15.5 percent of the world's overall GDP. It is expected to reach 25 percent in less than a decade, quickly outpacing the growth of the overall economy. However, countries like South Africa are still currently only capturing only a fraction of this growth and need to strategically invest in the foundational elements of their digital economy to keep pace.

Universal adoption and effective application of digital technology is expected to characterize economies of the future, shaping their ability to succeed in the global marketplace and offer a better quality of life for their citizens. Disruptive technologies are already altering traditional business models and pathways to development, yielding significant efficiency and productivity gains, increased convenience, as well as supporting better access to services for consumers. Well-functioning digital economies thus may offer potential to achieve faster economic growth, offer innovative products and services, as well as create more job opportunities. The disruptive technologies coming onto the market also carry risks that need to be managed and mitigated, for example, job losses in industries affected by structural change and automation. Assessing where strategic investments and interventions need to be made is a critical first step to enabling digital economy growth.

Figure 2: The digital economy can bring shared prosperity and reduced poverty
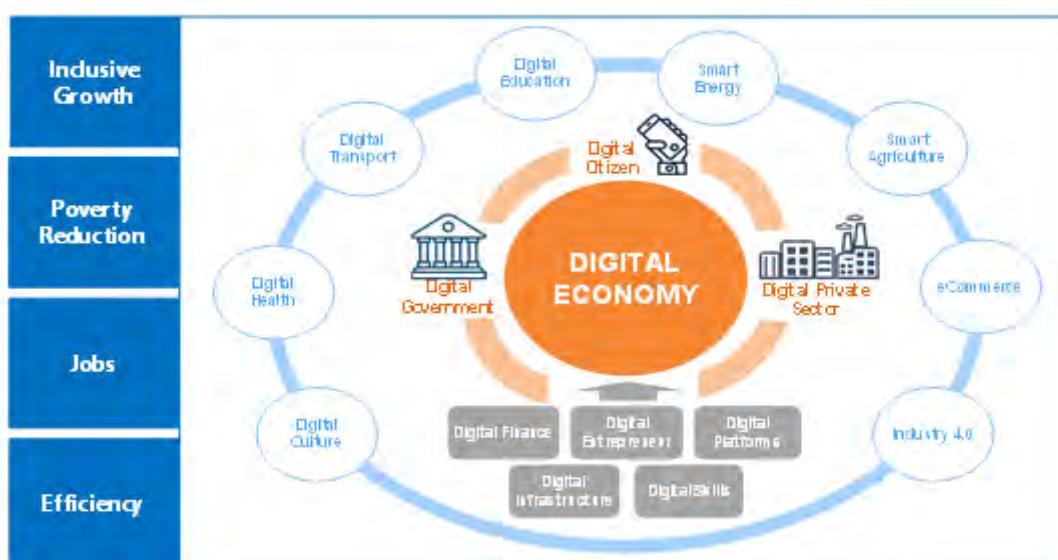
The framework that shapes the assessment looks at five foundational elements of the digital economy:

- Digital Infrastructure: the availability of affordable and quality internet, which is instrumental to bringing more people and businesses online.
- Digital Public Platforms: the presence and use of digital platforms that can support greater digital exchange, transactions and access to public services online.
- Digital Financial Services: the ability to pay, save, borrow, and invest through digital means, which is key to financial inclusion and increasing the e-commerce market.
- Digital Entrepreneurship: the presence of an ecosystem that supports entrepreneurs, startups and bigger companies to generate new products and services that leverage new technologies and business models, including private platforms, which is critical to widen and deepen digital economic transformation.
- Digital Skills: the development of a tech-savvy workforce, with both the basic and advanced digital skills to support increased technology adoption and innovation and enable investments in high value-added services.

This report aims to highlight opportunities to further develop South Africa's digital economy with a special focus on policies that can bridge the digital divide and help South Africa achieve the DE4A targets. As discussed in the recent SCD, the legacy of exclusion presents unique challenges in South Africa, and this is true also in the digital space. Based on quantitative and qualitative assessments, and a series of more in-depth background papers on four of the DE4A's five pillars (digital infrastructure, digital skills, digital entrepreneurship and digital financial services), the diagnostic findings provide recommendations that inform country targets and decisions on priority areas for development, proposing a mix of possible policy reforms and interventions.

Figure 3: The Africa-wide proposed DE4A targets across the five pillars of the digital economy

ACKNOWLEDGEMENTS

LIST OF ACRONYMS

4IR	Fourth Industrial Revolution
12J	Section 12J of the Income Tax Act which allows for the creation of VCCs
AI	Artificial Intelligence
API	Application Program Interface
AU	African Union
B-BBEE	Broad-Based Black Economic Empowerment
CDD	Customer Due Diligence
COMESA	Common Market for Eastern and Southern Africa
CPSD	Country Private Sector Diagnostic
CRC	Cybersecurity Response Committee
CSD	Central Supplier Database
CSIR	Council for Scientific and Industrial Research
CSIRT	Computer Security Incident Response Teams
DBE	Department of Basic Education
DE4A	Digital Economy for Africa
DHA	Department of Home Affairs
DHET	Department of Higher Education and Training
DFS	Digital Financial Service
DST	Department of Science and Technology
DPSA	Department of Public Services and Administration
DSBD	Department of Small Business Development
DTI	Department of Trade and Industry
DTPS	Department of Telecommunications and Postal Services
e-GP	Electronic Government Procurement
ECT Act	Electronic Communications and Transactions Act
ESD	Enterprise and Supplier Development, a subsector of B-BBEE
GCIS	Government Communication and Information Services
GDP	Gross Domestic Product
GITOC	Government Information Technology Officer's Council
GPW	Government Printing Works
HANIS	Home Affairs National Identification System
ID	Identity Document
IT	Information Technology
ICT	Information, Communication and Technology
IFWG	Intergovernmental Fintech Working Group
IDC	Industrial Development Corporation
iNeSI	iKamva National e-Skills Institute
IP	Intellectual Property
ITU	International Telecommunication Union
FIC	Financial Intelligence Center
KYC	Know Your Customer
M&E	Monitoring and Evaluation
MFD	Maximizing Finance for Development
MIC	Middle-Income Country

MICT	Media, Information and Communication Technologies
MIOS	Minimum Interoperability Standards
NDP	National Development Plan
NPS	National Payments System
NSA	National Skills Authority
NPD	National Populations Database
NIPMO	National IP Management Office
OGCIO	Office of the Government Chief Information Officer
OGP	Open Government Partnerships
PASA	Payments Association of South Africa
PKI	Public Key Infrastructure
POPI	Protection of Personal Information Act
PPP	Public-Private Partnerships or Purchasing Power Parity
R&D	Research and Development
SA	South Africa
SADC	Southern African Development Community
SARB	South African Reserve Bank
SASSA	South Africa Social Security Agency
SCD	Systematic Country Diagnostic
SETA	Sector Education and Training Authority
SITA	State Information Technology Agency
SOE	State-Owned Entity
SMEs	Small & Medium Enterprises
SSA	Sub Saharan Africa
SSC	Shared Service Center
STI	Science, Technology and Innovation
TVET	Technical and Vocational Education and Training
USD	United States Dollar
VAT	Value-Added Tax
VC	Venture Capital
VCC	Venture Capital Company as defined by 12J of the Income Tax Act
WBG	World Bank Group
WEF	World Economic Forum
WOAN	Wireless Open Access Network
ZAR	South African Rand

The overall state of South Africa's digital economy as viewed through the lens of the five foundational pillars is encouraging but momentum has stalled in recent years and much of the population remains excluded from the digital economy. With a PPP adjusted GDP per capita of USD 13 000, South Africa is among the few countries in Africa with upper-middle income status. On the digital economy, South Africa leads the region in indicators such as internet usage (54%) and mobile phone penetration (80%), and broadband coverage (99%). However, the nation slipped from 78th in the ITU ICT Development Index to 92nd between 2002 and 2018 against the backdrop of a slowdown in economic growth. And when benchmarked against other middle-income countries and more dynamic economies, South Africa lags behind. Internet usage among poorer South Africans remains low with as much as 60% of the population paying more than the affordability benchmark of 2% of GNI per capita.

Proactive, effective, and coordinated government policies to holistically support the digital economy and could yield competitiveness, growth and jobs in South Africa. The World Bank Country Private Sector Diagnostic report identified ICT as a sector where medium-term reforms could unlock private investment. Already in 2013, an assessment showed that increased broadband investment of R 65 billion in the following 10 years could create more than 400,000 jobs and add R 130 billion in the GDP of South Africa[1]. Policies with strong monitoring and evaluation will be needed to reduce risks from increased automation and digitization. For example, doubling the rate at which the workforce acquires skills needed for the 4iR could reduce the proportion of at-risk-jobs from 33 percent to 14 percent by 2025.[2] And as recently noted in South Africa's Doing Business 2018 report for eight major cities, digitalization can remove red tape through government platforms that enhance the business environment.

South Africa has good potential to build on its strong foundations to continue to grow and expand its digital economy, including playing an increasing regional leadership role, and should boost efforts on digital infrastructure and skills in particular. A holistic, coordinated and whole of government view on the different actions necessary on each of the pillars, including their linkages, would help unlock maximum benefits. The diagnostic finds that South Africa should focus efforts on current regulatory tools covering infrastructure and skills which need to be better implemented and complemented with targeted interventions to help underserved segments of the country. Priority recommendations of the diagnostic include for infrastructure, updating the national broadband policy SA Connect in line with international best practices, fast-tracking spectrum licensing and ensuring the independence and capacity of ICASA, which are measures that can unlock private investment and move South Africa towards universal coverage of high-speed and affordable internet. With regards to skills, government should consider improving the enrolment and completion rates in ICT studies as well as fostering more partnerships with private sector in reforming the curriculum and providing resources to schools. Beyond these two pillars, anchoring the different Digital Economy interventions across the five pillars with a high-level initiative, such as the Presidential Commission on 4iR for example, could be useful to ensure efficient coordination of implementation of actions and reforms. Moreover, building on the objectives of the AU, CATFA, SADC and COMESA of greater economic integration, South Africa could play a leading role on the digital economy development across the continent.

---

[1] Katz R.L. (2013) The impact of South Africa Connect on jobs and the economy. Presentation in the Broadband Workshop (DoC) 11-12 November
[2] https://www.accenture.com/t20180201T173907Z__w__/za-en/_acnmedia/PDF-70/Accenture-Creating-South-Africa-Future-Workforce.pdfla=en

There is a growing economic and social urgency for South Africa to develop its digital economy. Over the past decade, the economy has not been growing fast enough to create jobs. The unemployment rate is 27%, inequality has increased, and half of the population lives in poverty. The dualism that stems from the legacy of demographic and spatial exclusion in South Africa is reflected in the digital economy landscape, and a large share of South Africans remain disconnected from the opportunities it has created. Whereas the Government of South Africa has been consistent in trying to leverage ICT for socio-economic development since the 1990's, policy choices have not always been optimal, or there has been difficulty to implement outlined reforms and programs as demonstrated under many of the foundational pillars. The policy and regulatory uncertainty have undermined and slowed down private investment. Advances in digital technology present an opportunity for South Africa to reverse declines in competitiveness and service delivery and push towards a dynamic and inclusive growing economy in line with the goals of the National Development Plan.

This report uses the DE4A methodology to propose a rapid and holistic examination of the five pillars of the digital economy in South Africa, namely digital infrastructure, digital government platforms, digital financial services, digital entrepreneurship and digital skills, and is based on a series of background papers produced for this report. The following are a summary of diagnostic findings by pillar.

KEY FINDINGS

Digital Infrastructure

The overall state of South Africa's digital infrastructure is relatively robust and has enabled progressively better market outcomes for consumers. In the 2016 WEF Networked Readiness Index, South Africa was the second best performing African country and mobile download speeds are the fastest on the continent. In the past 10 years, it has moved to an open, competitive regime in terms of its international connectivity, with a good number of submarine cables connecting it to the rest of the world, resulting in fast growth of international bandwidth usage.

The Mobile Network Operators (MNOs) have played an important part in providing connectivity throughout the country, resulting in impressive 3G and 4G network coverage, while international connectivity benefited from away from monopoly after 2009 to an open and competitive regime. The Digital Economy for Africa target of 100% of population covered by mobile broadband networks is almost reached. Fixed-line internet and especially fiber-optic connections to homes and businesses (FTTX) have experienced rapid growth in recent years, showing much promise. In international connectivity, competition translated resulted in 5 international submarine cables with more to come online, lower prices and rapid increase in international bandwidth usage, which more than doubled from 2016 to 2018. South Africa possesses the most extensive backbone infrastructure on the continent, with around 200,000 kms of fiber deployed, but concentrated in urban areas and with much network duplication. The expansion of infrastructure can be largely contributed to commercial fiber operators, even though the state has a strong role in the sector. South Africa also has a strong non-profit national research and education network, SANREN.

However, there are concerns about the country's performance. South Africa has experienced much policy uncertainty and has been slow to implement regulatory reforms, and the country is facing a major digital divide. Delays in spectrum assignment have limited the operators' ability to expand their 4G networks and provide faster speeds on existing networks. Most targets of the national broadband strategy, SA Connect,

have not been reached and the strategy needs updating. Also, whilst the urban metro regions are benefitting from an expansion of fiber optic cable infrastructure, preparing for the arrival of 5G networks and having increased consumer choice for fast internet connectivity, rural areas are being left behind. As extending mobile broadband coverage is becoming a less important issue, the divide is explained more by affordability and characterized by quality of access. South Africa's Quality of Service is regarded as poorer than in comparable countries and mobile data prices are high, especially for poorer, more rural consumers. The current regulatory and market regime is not resulting in sufficient digital inclusion, and the state-run programs for advancing access have not been able to fill the gap.

Digital Public Platforms

South Africa is one of the leaders on digital public platforms in the region - second only to Mauritius in Africa - based on the 2018 UN's e-Government Development Index (EGDI). Digital public platforms serve as an important enabler of digital economy allowing both public and private sector organizations to come up with new or better outcomes for citizens. Citizen participation in particular is a strong point for South Africa. The government has adopted solid strategies in the National e-Government Strategy and Roadmap in November 2017 to guide the country's digital transformation. Although the activities outlined in the Strategy are in various stages of implementation, funding appears to be a challenge. At the sub-national level, progress is being made at the provincial levels, especially in Gauteng and Western Cape, where much drive for government innovation happens.

There is significant fragmentation and proliferation of institutions at the national level responsible for various platforms and ICT services that is hindering further development. The main institutions have overlapping mandates and blurred, overlapping, and sometimes undefined responsibilities. The institutional picture looks more cohesive at the provincial level. In terms of data protection and protection of 'privacy', South Africa has an appropriate legislative framework in place, but the ability to share data between Departments and Agencies is restricted. Open data policy and initiatives are still at a pilot phase, with benefits yet to be reaped. Capacity to use big data analytics within the public sector is being developed. Key back-office systems are mostly digitized in South Africa at the national level. South Africa has a recently-updated national-level policy document on interoperability with SITA having a central controlling role. However, legacy systems and lack of connectivity pose hurdles for implementation. No strong push for mainstreaming open Application Program Interfaces (APIs) within the public sector exists.

South Africa has a strong existing national ID system, which is largely used for face-to-face transactions, but the repositioning of the Department of Home Affairs (DHA) and desire to introduce a new National Identity System (NIS) are an opportunity to build a world-leading digital identity system to underpin trust in the digital economy and boost digital trade with Africa and beyond. Coverage of South Africa's national ID system is above 90 percent, which places South Africa among the highest in the world and is a great asset for introducing the NIS as a next generation digital identity system. However, it will be important for the NIS to be designed as a platform and with interoperability in mind (rather than as a silo), and for the Government to examine options beyond a centralized system such as a federated model that would create an ecosystem of trusted public and private sector digital identity providers that would be regulated and supervised by Government.

The national e-Strategy places much emphasis on digital services and encompasses several specific objectives linked to public service delivery and innovation both in public and private sector, including developing capacity and skills for effective service delivery. A National e-Government Central Portal had

been launched in 2018, for access to selected online services, as a part of new e-Government roadmap; however, there is currently no inventory or registry of all online services maintained by DPSA or DTPS. Therefore, it is not immediately possible to take stock how many services have been automated and at what level.

Digital Financial Services

Digital financial services provide individuals and households with convenient and affordable channels by which to pay, as well as to save and borrow. According to the 2017 Global Findex survey, 60 percent of South African adults (ages 15+) reported having made or received a digital payment in the past year, well above Sub-Saharan Africa (SSA) average. Traditional account ownership among South Africans is also significantly higher than in the Sub-Saharan Africa region and on par with middle-income countries (MICs). South Africa's large and sophisticated banking system (108 percent of GDP) offers an array of products and services and is investing in digitization to further expand its product offerings through incumbent large banks and the entry of new players.

But South Africa's financial services are characterized by stark dualism. The usage of debit cards (other than for cash withdrawal) and other electronic payment instruments remains low among low income households with cash dominating their means of transacting. Moreover, only a fifth of adults used mobile phone or internet to access their accounts, substantially lagging Kenya at 72 percent. As the World Bank South Africa Retail Banking Diagnostic (2017) highlighted, product design and fees on transaction accounts by major banks do not distinguish between low-income and high-income customers thus making these products costly for low-income customers. In addition, consumers may be reluctant to use internet or mobile banking due to high cost, including the cost of data / airtime to access such electronic services, as highlighted in the financial infrastructure section of the report.

While it is growing and gaining international recognition, South African fintech is relatively strong with 219 companies, benefiting from good mobile phone and internet penetration. However, several key challenges remain. In South Africa only locally-registered banks may issue e-money, since issuing e-money is considered as deposit-taking and this has in part resulted in low usage of mobile money despite a high mobile phone penetration. Non-banks argue that the low percentage is due to legal framework that requires non-banks to offer their services jointly with a bank, which reduces profitability and flexibility in their product and service offering.

At the regional level, the developments in South Africa digital financial services have strong implications, especially in the SADC region. South African banks have expanded extensively in Africa; the 5 largest banks currently have 69 foreign subsidiaries, of which 43 are in Africa. Importantly at SADC level, in July 2014 the SADC financial industry launched a wholesale cross-border payments system known as the SADC Integrated Regional Electronic Settlement System (SIRESS). Participants to this system include banks and central banks in the region with the SARB acting as the operator and settlement agent of the system. The launching of SIRESS laid the foundation for developments in low value payment streams which are critical for supporting cross border remittances and promoting financial inclusion within the region. In this context, a low value credit transfer scheme is being implemented to facilitate bank-to-bank transfers, bank-to-non-bank transfers and non-bank-to-non-bank with settlement taking place via banks. The direct participation of banks and non-banks in this scheme will be a positive development that will facilitate interoperability, promote competition, increase beneficiary reach and reduce cost of transacting.

Ultimately, financial inclusion levels are expected to increase as customers get easy access through mobile instruments.

Digital Entrepreneurship

South Africa is already a key digital entrepreneurship player in Africa, serving as a "hub" for many initiatives and investments on the continent, but its leadership is being increasingly challenged, as it is being held back by key policy, regulatory and human capital bottlenecks. Vibrant digital entrepreneurship is a key pillar of a strong digital economy, leading to new products and services, business models, markets, and in the end growth and jobs. A host of tech players, investors, and success stories, along with existing national and provincial-level support, has set a strong foundation that is already leading to some notable successes, including a round of startups raising over $USD100M. The sector remains however overwhelmingly white, male, and middle class. Digital talent is rare at all skill levels and becoming a critical bottleneck for growth of digital startups, particularly for higher-end/global skills. Issues in implementation and coordination of policies, coupled with limited monitoring and evaluation, are likely leading to a sub-optimum allocation of resources, and South Africa is losing ground on digital entrepreneurship leadership to other rising continental tech hubs, including the likes of Kenya, Rwanda, Botswana, and Nigeria. Specific policies including the R&D tax incentive scheme, IP legislation, exchange controls, and labor legislation are also currently hindering entrepreneurial growth.

Further strengthening of the numerous digital entrepreneurship support services provided by organizations and increasing access to early and growth stage finance is needed to help South African digital entrepreneurs scale. Sector-specific clusters are developing, e.g. around fintech, edtech, or agritech, some attracting substantial foreign investment. Most support is provided in the early stages of business set-up and is highly geographically concentrated in the affluent urban areas of Gauteng and the Western Cape. The quality of business support services provided by many organizations is considered low, with few relevant mentors; digital acceleration programs are not well tailored to the South African context in terms of duration and are insufficiently geared for access to markets beyond South Africa. Availability of early and growth-stage finance for growth-oriented businesses has increased significantly over recent years, in the context of difficult access to credit for SMEs overall, but needs to be further increased to help high potential digital businesses grow. Supply increase has come mostly for more mature digital businesses thanks to a significant tax incentive. Finance gaps persist throughout most of the lifecycle of digital startups, including the very early stage. Although leading the way on the African continent, most South African later stage funds also still lack sufficient capacity, inclusiveness, and critical size to fund and facilitate rapid internationalization of South African digital businesses.

Access to both the domestic, regional and international markets continues to be difficult for South African digital entrepreneurs, pleading for greater regional programs and integration. South Africa is a key entry point for global digital companies on the continent and an expanding digital market, and many local digital business models and services have developed. The high cost of data does remain a challenge, and key players with growth and job potential, like e-commerce and other digital private platforms, face restrictions and costs for processing online payments. Long private and public procurement cycles disadvantage smaller players. ICT services exports data show limited global reach, compounded by ExCon difficulties, while the local market remains limited compared to richer countries due to infrastructure and persistent inequalities.

Digital Skills

South Africa's digital skills are a key weakness for the development of a South African digital economy. The development of a vibrant, dynamic and inclusive digital economy requires a pool of skilled digital entrepreneurs to build new businesses, and a deep labor pool to work with technology. This is an area that requires attention, as the South African labor market is characterized by critical skills shortages that are more acute in sectors such as ICT. The demand for specialized digital skills is rapidly increasing, with 3,000 of the 10 most sought-after ICT jobs not filled, 25 jobs listed on the Department of Higher Education and Training's (DHET) occupations in high demand are in ICT fields, and LinkedIn data showing that 10 out of the 11 most in demand skills are in the ICT sector. The SCD and the CPSD outline skills as the key mechanism through which South Africa can foster competitiveness and economic inclusion, this could not be truer for the ICT sector. Skills are also critical in making sure that 4iR does not lead to massive job losses.

Digital skills weaknesses stem from quality lags of South Africa's education system. Even though South Africa is leading African countries in some aspects of digital developments, it only ranks 116th out of 140 countries in the Global Competitiveness Report's assessment of digital skills among the population. South Africa ranks at a low 126th out of 157 countries on the World Bank's Human Capital Index, below peer African countries with less income. When schooling is adjusted for learning, the average 18-year-old would have completed 9.3 years of actual schooling, but a learning equivalent to 5.1 years, implying a learning gap of over 4 years. Weak outcomes in basic education in turn result in low tertiary education enrollment and low graduations - including in ICT related qualifications.

Other weaknesses in digital skills relate to governance, curriculum and resources. While significant progress has been made by the DTPS to develop the iKamva National e-Skills Institute (iNeSI), conduct large-scale environmental scans to determine digital skills needs, and indications of developing a digital skill strategy, these initiatives are still in early stages and not directly linked to the broader skills development work done by the DHET, NSA, or SETAs. Therefore, to date, there is a lack of identification of specific digital skills that need developing in each of the levels of digital skills. Digital skills development in schools also still has a long way to go. Many schools are still without devices and connectivity, many do not offer ICT-related subjects, and there are concerns about teacher training in effective technology use. All of this hinders digital literacy. With regards to professional digital skills, the production of post-school graduates does not meet labor market demands and curricula are not responding fast enough to meet rapid changes in demand. The development of professional digital skills is also impaired by a lack of coherent, national leadership and collaboration, which leads to lack of coherence in institutional offerings. And finally, only some universities are recognizing the link between entrepreneurship, business, and ICT skills which hinders e-business skills

South Africa is one of the digital economy leaders on the African continent, but lags developed countries. With a population of 57.7 million people, a GDP of over USD 350 billion and a PPP-adjusted average income of USD 13,000, South Africa is among the few countries in the region with upper-middle income status. The ICT sector contributes around about 17 percent of service exports and close to 3 percent of GDP.[3] With internet usage of more than 54 percent in 2017, South Africa is among the leaders in Africa[4] but lags behind many developed economies and other middle-income countries (MIC). Smartphone penetration rates are also relatively high, with more than 80 percent of the population owning a smartphone. Moreover, the country is ranked of 46th out of 140 countries for innovation capability by the World Economic Forum (WEF) Global Competitiveness Report.

In this context, the Digital Economy for Africa targets appear within reach for South Africa, although efforts need to be maintained. Launched in 2018 through a collaboration between the African Union (AU) and the World Bank, the Digital Economy for Africa Initiative aims to ensure that every individual, business and government in Africa will be digitally enabled by 2030. With strong fundamentals such as a relatively strong manufacturing base, a critical mass of private sector firms, deep and diversified financial and capital markets, competence in research & development, several internationally recognized universities, and wide coverage of mobile broadband, it is estimated that over the next decade, more than ZAR 5 trillion in value could be created in South Africa through the use of digital technologies in key industry sectors, including agriculture, public infrastructure and administration, financial services and manufacturing.[5]

South Africa could also play a leading role for regional digital development, particularly within the context of the recently signed Continental Free Trade Area (CFTA) agreement, as well closer to home in the Southern Africa Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA) context, following on the East Africa Single Digital Market as an example. This could be all the more important given that the World Bank's Systematic Country Diagnostic (SCD) identified limited integration into global value chains as one of the major constraints to growth in South Africa. Closer cooperation between the region's countries would also help in creating more value out of public and private infrastructure investments such as fiber-optic backbone networks and data centers. South Africa could assist by leading the agenda to harmonize customs, disseminating best practices to other countries around issues such as data regulation, improvement in the ecommerce environment, promotion of Africa-wide payment systems and the provision of an even stronger regional hub for tech entrepreneurs.

In this context, the South African government is aiming to pass several reforms across core elements of the digital economy, recognizing the need for new policy directions and preparing for the 4iR. In its Industrial Policy Action Plan, the government of South Africa identified ICT as among 12 priority sectors that can grow and create jobs. In 2016, the National Integrated ICT Policy White Paper defined the overarching ICT policy framework. One important action taken in 2018 was to initiate the merger of the Department of Telecommunications and Postal Services (DTPS) and the Department of Communications (DoC) to improve the overall institutional framework to promote faster decision making and clarifying

---

[3] Statistics South Africa (2017) Statistical Release P04414 Available online
http://www.statssa.gov.za/publications/P0441/P04414thQuarter2018.pdf
[4] Research ICT Africa (2018) The State of ICT in South Africa, Policy Paper No.5, Series 5, Accessed online https://researchictafrica.net/wp/wp-content/uploads/2018/10/after-access-south-africa-state-of-ict-2017-south-africa-report_04.pdf
[5] Accenture (2018) "Unlocking digital value for business and society in South Africa."

mandates, which has been confirmed in the latest government nominations. In September 2019, South Africa will join the WEF Centre for the 4iR Network (C4IR Network) alongside China, India and Japan.[6] In March 2019, the Presidential Commission on the 4IR was announced.[7] The commission is chaired by President Cyril Ramaphosa and aims to identify relevant policies, strategies and action plans that will position South Africa as a competitive global player.[8]

Yet more efforts are needed to tackle entrenched socio-economic exclusion, which has resulted in keeping household income at low-levels and preventing MSMEs from fully participating in opportunities offered by the digital economy. At 0.63, the Gini coefficient measuring income dispersion in South Africa is among the highest in the world, and around half of the population live in poverty.[9] While South Africa's wealthy households have broad access to quality and relatively affordable internet, people earning less than ZAR 7000 a month are largely unconnected.[10] This report reviews how the digital divide affects the foundations of the digital economy and provides policy options for bridging the divide.

Furthermore, while South Africa is a regional success story of attracting private investment into digital economy, since 2009 FDI into the digital economy has been falling.[11] Significant investments in fiber-optic networks made over the past decades have endowed South Africa the most extensive backbone infrastructure in Africa[12], while investment from MNOs have enabled almost universal coverage of mobile broadband networks. But since 2010, the regulatory, policy and business environment has been less conducive to private investment. Regarding digital infrastructure specifically, notable constraints to private investment in digital infrastructure include delays in allocating high demand spectrum and policy uncertainty around the Wireless Open Access Network (WOAN). Moreover, based on the findings, in specific areas such as broadband roll-out or government service digitalization, the government appears to rely excessively on its own resources and capacities, at times leading to inefficient, expensive and incomplete project implementation. Overall, there is room to consider leveraging more private investment and expertise in key areas such as infrastructure deployment, skills development and the roll-out of e-government platforms. This is especially pertinent in the context of the South African Government's commitment to fiscal consolidation. [13]

Moreover, South Africa's private sector has been slow to adopt digitization, particularly in the manufacturing sector where competitiveness has been declining. None of the South African manufacturing companies surveyed in PWC's Digital Champions report are frontrunners in digitalization

---

[6] The WEF established the C4iR in San Francisco, USA in March 2017 as a hub for global, multi-stakeholder cooperation to develop policy frameworks and advance collaborations that accelerate the benefits of science and technology. The South African government, through the Department of Science and Technology (DST), intends to establish a WEF Affiliate Centre as a public-private partnership based at the Council for Scientific and Industrial Research (CSIR).

[7] The full list of commissioners compromising labour, private sector, academic, women and youth can be found at https://www.bizcommunity.com/Article/196/831/189620.html

[8] In 2018, Telkom and several universities established the 4IR South Africa partnership with the objective of stimulating and facilitating an inclusive national dialogue to shape a coherent national response to the 4IR. The partnership also aims to complement and support other national activities relating to 4iR - most notably the recently appointed Presidential Commission on 4IR.

[9] This based on the upper-bound poverty line of ZAR 1 183 (in April 2018 prices) per person per month. This refers to the food poverty line plus the average amount derived from non-food items of households whose food expenditure is equal to the food poverty line.

[10] Research ICT Africa (2018) The State of ICT in South Africa, Policy Paper No.5, Series 5,

[11] Financial Markets Data

[12] Research ICT Africa (2018) The State of ICT in South Africa

[13] Maximizing Finance for Development (MFD) is the World Bank Group's approach to systematically leverage all sources of finance, expertise, and solutions to support developing countries' sustainable growth.

of operations.[14] In fact, most fall into the "digital novice" category - which represents the least digitally mature companies. These firms are missing out on cost-saving, productivity gains and revenue growth. The competitive gap between dynamic economies such as in the Asia Pacific region (which are digitalizing much more quickly) will thus continue to widen unless action is taken[15]. In other segments such as e-commerce where South Africa lags - 1.4 percent of total sales compared to the global average of 11.5 percent-, barriers could be coming from the demand side including issues such as lack of trust and consumer culture.

Accelerated development of the digital economy is critical to unlock economy-wide investment, create much needed jobs, and help reverse the productivity decline in South Africa. The recent Country Private Sector Diagnostic (CPSD) identifies the ICT sector as one of the sectors where short- to medium-term reforms, notably aimed at addressing the digital divide, would unlock private investment and create jobs[16]. Even in a context of heightened economic and policy uncertainty, the ICT industry has demonstrated resilience in job creation, with employment in the telecommunications sector alone growing by 6.2 percent over the last five years[17]; LinkedIn data shows that 10 out of the 11 most in demand jobs in South Africa are in the ICT sector. Moreover, empirical estimations from the Future of Work study show that faster internet adoption improves the prospects of finding a skilled job without reducing the prospects of finding an unskilled.[18] More generally, in a context where 6.2 million South Africans are actively looking for jobs but cannot find them[19], putting in place technologies to better advertise vacancies and help people start their own companies by lowering barriers to entry and improving access to markets relative to other industries would go a long way toward improving job market prospects.

The consequences of inaction are high, and South Africa is also already experiencing an exodus of skills that could dampen its digital economy ambitions. LinkedIn data tracking cross-country movements of professionals across industries indicate that computer software has one of the highest rates of migration out of the country, and that half of the skills lost to migration out of South Africa are in the ICT sector and are concentrated in skills that are critical for the 4iR. While such migration can also be seen in other MICs, it is happening at a faster pace in South Africa. It also takes place in a context where ICT skills are already scarce, immigration requirements are cumbersome, and skilled workers command a skills premium[20]. As ICT is an industry with high skills intensity, these developments act as a drag on cost competitiveness and lessens the interest of investors that would like to anchor their ICT operations in South Africa to serve a pan-African market.

The remainder of this report will provide a diagnostic and offer recommendations on the five foundations of the digital economy in South Africa. The report will examine, in turn, challenges concerning digital

---

[14] PWC (2018) "Digital Champions: How industry leaders build integrated operations ecosystems to deliver end-to-end customer solutions", surveyed 1,155 executives at global manufacturing companies in 26 countries including South Africa and asked them about their views on Industry 4.0 and digital operations. Based on the outcomes, PwC developed a digital maturity index to explore the role of frontrunners – the so-called 'Digital Champions" – and what distinguishes them to outpace their competitors.
[15] Deloitte (nd) "Industry 4.0: Is Africa ready for the digital transformation?"
[16] World Bank (forthcoming) Creating Markets in South Africa: Boosting Private Investment to Unlock Growth Potential, Country Private Sector Diagnostic, Washington DC
[17] ICASA (2019) State of the ICT Sector Report 2019. .
[18] Hjort and Poulsen (2019) Future of Work
[19] When discouraged workers are also included, the unemployment rate is 34 percent.
[20] World Bank (forthcoming) Creating Markets in South Africa: Boosting Private Investment to Unlock Growth Potential, Country Private Sector Diagnostic, Washington DC

infrastructure, public digital government platforms, digital financial services, digital entrepreneurship, and digital skills.

2.1. BACKGROUND AND IMPORTANCE OF DIGITAL INFRASTRUCTURE

Fast, high-quality and affordable broadband internet is a key foundation of the digital economy. Increased connectivity affects economic growth, productivity, firm performance and efficiency and quality of public institutions and services in a positive way[21]. The effect of increased broadband access on economic growth and employment has been well documented[22]. By enabling improved access to information governments can be made more accountable to citizens, and citizens connected to opportunities for learning and employment.

For this report, digital infrastructure is analyzed in four parts: (1) the first mile (South Africa's international connectivity), (2) the middle mile (national backbone and long-distance networks), (3) the last mile (access networks connecting the end-user) and (4) the invisible mile (policies and regulations promoting or hindering broadband access). Special attention will be paid to the market for both fixed-line and mobile broadband services in different parts of the broadband value chain.

In the Networked Readiness Index of the WEF Global Information Technology Report from 2016 South Africa performed well and rose to the position of 65th as the second best performing African country. Gains were made especially by businesses, and improvements were evident in infrastructure and affordability. Based on data from Ookla[23], South Africa comes first in Africa on mobile internet download speeds. Commercial cloud providers such as AWS and Huawei have entered the market with big growth prospects[24].

However, South Africa has slipped in the ITU's ICT Development Index from position 78 to 92 between 2002 and 2018 trailing behind emerging market competitors such as Brazil, Mexico, Turkey and India, much due to lack of progress on infrastructure. It's performance on fixed broadband speeds is not as favorable as mobile, ranking at position 102 globally, behind several other African countries. South Africa suffers from a persistent digital divide, with almost half the country still not using the internet. The urban metro regions are enjoying an expansion of fiber optic cable infrastructure, preparing for the arrival of 5G networks and benefiting from increased consumer choice for fast internet connectivity, but rural South Africa is being left behind. Multi-faceted problems around affordability, lack of internet-enabled devices, limited demand and poor skills hinder progress towards universal access[25].

The South African policy and regulatory environment has sound legal and institutional foundations, although it has suffered from much uncertainty in recent years. There has been a lack of clear policy direction in key questions such as wireless spectrum allocation and licensing and difficulties in implementing agreed regulatory reforms. The ability of the Independent Communications Authority of

---

[21] World Development Report 2016. Digital Dividends. World Bank, 2016.
[22] For a latest review of evidence see: The economic contribution of broadband, digitization and ICT regulation ITU (2018). On employment effects, see: Hjort J. and Poulsen J. (2018) The Arrival of Fast Internet and Employment in Africa. NBER Working Paper No. 23582
[23] www.speedtest.net Data from: Q3 / 2019
[24] https://businesstech.co.za/news/cloud-hosting/279877/amazon-web-services-to-open-new-data-centres-in-south-africa/ and https://techcentral.co.za/huawei-cloud-now-available-in-south-africa/87985/
[25] Research ICT Africa (2018)

South Africa (ICASA) to effectively regulate the digital communications sector[26] has been questioned. Several experts interviewed for this report stated that the regulator's independence and capacity have weakened over the past few years. This has caused some key processes such as spectrum licensing to be seriously delayed[27]. There are signs of a turnaround strategy. President Ramaphosa in 2018 announced that his government will work to implement reforms and fast-track delayed spectrum assignment. These efforts are also being coordinated under the new Presidential Commission on the 4th Industrial Revolution (4IR)[28], which will focus on digital infrastructure as one of its themes.

Despite a dedicated Universal Service and Access Agency (USAASA) managing The Universal Service and Access Fund (USAF), the growing demand for services has largely been met by operators on commercial terms. Over the lifespan of the USAF, only some ZAR 620 million had been allocated to projects under the USAF by the Treasury and the role of USAASA in promoting internet access in South Africa has been marginal. The USAF is currently being consolidated into a new Digital Development Fund (DDF) with a broader mandate, possibly repurposed to contribute better to the SA Connect's objectives and to promote innovation in the digital sector. This is a step that most stakeholders welcome.

The National Integrated ICT Policy White Paper (2016) by the Department of Telecommunications and Postal Services set out key objectives for developing the ICT sector in South Africa. The White Paper addressed issues such as establishing cross-government leadership in ICT, promoting innovation and competition, strengthening regulation, addressing the digital divide and ensuring affordable access. It extended and reinforced existing strategies including the national broadband strategy South Africa Connect (SA Connect)[29] and the National Cybersecurity Policy Framework[30].

The South Africa Connect (SA Connect) broadband policy from 2013 set ambitious targets for improving internet access and connecting government facilities. It aimed to extend a minimum of 5Mbps broadband access to 90% of the population and 100Mbps to 50% of the population by 2020. The long-term target for 2030 was set at 100% of the population connected at 10Mbps and 80% at 100Mbps. In addition to these, several institutional targets were set, aiming at connecting all government facilities by 2020 at speeds ranging from 10Mbps to 100Mbps. The implementation of SA Connect has been delegated to three publicly owned entities: Broadband Infraco (BBI), State Information Technology Agency (SITA) and Sentech with downstream participation by other private operators. Progress has been slower and costlier than expected and South Africa is not on track to meet the 2020 targets for connected facilities or internet access, although the intermediary target of 50% internet access by 2016 has been achieved somewhere in 2017. Phase 2 of SA Connect is currently on hold, pending a feasibility study.

---

26 The sector is also subject to regulation by the Competition Commission of South Africa. In some areas, ICASA and the Competition Commission have overlapping powers and mandates.
27 For example, the planned spectrum auction that ICASA was planning to proceed with in 2016 was contested by the DTPS and finally cancelled by a High Court verdict.
28 https://www.gov.za/speeches/president-cyril-ramaphosa-appoints-commission-fourth-industrial-revolution-9-apr-2019-0000.
29 South Africa Connect. Creating Opportunities, Ensuring Inclusion. South Africa's Broadband Policy. 2013.
30 National Cybersecurity Policy Framework. 2015.

Table 1: SA Connect targets

Policy Target	Penetration Measure	Baseline (2013)	2016	2020	2030
Access / Mbps	% of population	33.7%	50% at 5Mbps	90% at 5Mbps, 50% at 100Mbps	100% at 10Mbps, 80% at 100Mbps
Schools	% of schools connected	25%	80% at 100Mbps	100% at 10Mbps, 80% at 100Mbps	100% at 1Gbps
Health Facilities	% of health facilities connected	13%	50% at 10	100% at 10Mbps, 80% at 100Mbps	100% at 1Gbps
Public Sector Facilities	% of government offices connected		50% at 5Mbps	100% at 10Mbps	100% at 100Mbps

2.2. DIAGNOSTIC FINDINGS: CURRENT STATE OF DIGITAL INFRASTRUCTURE

2.2.1. Analysis of the Broadband Market

Based on ITU statistics, 54% of South Africans were using the internet regularly in 2017, comparing favorably with countries such as Kenya, Nigeria and Mauritius, but lagging well behind world leaders such as Korea (Table 1). Mobile remains the primary means for people to get online in South Africa[31]. Overall wireless penetration in 2017 was at 162% with 5% growth from the year before. According to ICASA[32], mobile cellular data subscriptions increased from 61.4 million in 2017 to 65.8 million in 2018 and smartphone penetration has risen to 81.7% with rapid growth from 2016. 9 out of 10 mobile broadband subscriptions are pre-paid[33]. During the same year, fixed-line subscriptions increased by 147%, all implying good growth in internet access for 2018. It will nevertheless be highly unlikely that South Africa meets the SA Connect target of 90% penetration by 2020 based on the current trajectory.

Currently, there are four main MNOs operating in South Africa, the three largest of which jointly hold overall revenue market share of 95.3%[34]: Vodacom (49.8%), MTN (33.5%) and Cell-C (12%). Telkom, a company in which the government has a major stake is the fourth player. The latest entrant is the data-only operator Rain, which so far has a modest market share, but the most affordable data offering. Voice

---

31 57% of South African household's internet use in 2017 took place using mobile devices, highlighting the role that mobile connectivity plays. (Research ICT Africa 2018)
32 State of the ICT Sector Report 2019. ICASA 2019.
33 Ibid.
34 Data Services Market Enquiry. Provisional Findings and Recommendations. Competition Commission of South Africa 2019.

revenues have been falling as data services and OTTs have gained ground. Over the past three years, mobile data use has grown rapidly, between 55% to 68% annually.

Figure 4: Reported mobile subscriber market shares in 2018[35]
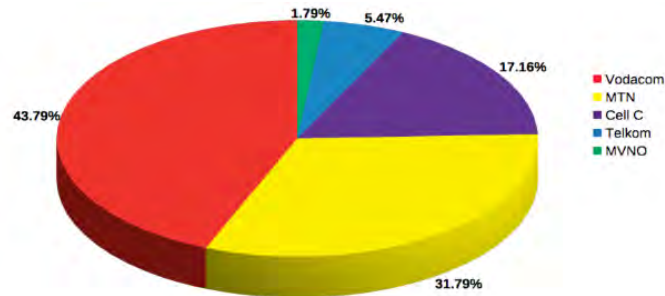
Source: Operators' Reports

In addition to infrastructure-based operators, South Africa has a growing number of Mobile Virtual Network Operators (MVNO) which were permitted in 2005. Altogether they hold around 2% share of mobile users, translating to around 1.8 million subscribers[36]. The MVNO market has attracted entrants from companies in other sectors such as retail, banking and consumer goods.

The fixed-line market in South Africa has recently received a boost, after years of being held back by an expensive operating environment. Market growth has been restricted to urban environments but has been impressive over the past years (growing to almost 7.5 million of xDSL and FTTX connections in 2018.[37] The role of Telkom is still significant, and it is the market leader with around 14% market share. The rest of the market is shared between many ISPs. In fixed-line broadband access, South Africa is currently making gains that have broader significance in Africa, where the fixed-line market is generally in its infancy.

---

35 Source: operators' reports, summarized at https://businesstech.co.za/news/mobile/266423/south-african-mobile-market-share-vodacom-vs-mtn-vs-cell-c-vs-telkom/
36 Telegeography GlobalComms Database, accessed 15 May 2019
37 This growth is not yet visible in ITU statistics, reported by ICASA 2019

Figure 5: Fixed-line subscriptions for the period ending 30 September each year
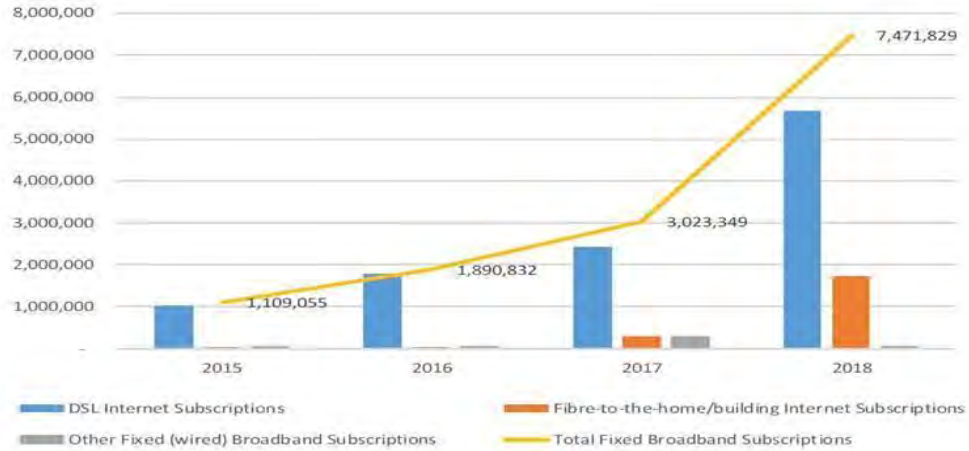
Source: ICASA Electronic Communications Questionnaire 2018

Table 2: Benchmarking penetration, affordability and coverage

Indicator	South Africa (65th on the NRI)	Kenya (86th on the NRI)	Nigeria (119th on the NRI)	Mauritius (49th on the NRI)	South Korea (13th on the NRI)
Internet penetration (ITU 2017)					
Internet usage (per 100)	54	16.6	26	53.2	92.7
Active mobile-bb subscriptions (per 100)	70	36	20	144.2	122.7
Fixed broadband subscriptions (per 100)	3.43	0.6	0.04	16.9	41.1
Affordability (ITU 2017)[38]					
Mobile broadband 1GB (% of GNIPC)	1.24	4	1.9	0.2	1.5
Fixed-BB basket (% of GNIPC)	2.73	37.9	14.9	0.6	1.2
Mobile-cellular basket (% of GNIPC)	1.24	4	1.9	1	0.4
Coverage (GSMA 2018)					
2G Population Coverage (%)	97.8	68.9	59.4	94.4	-
3G Population Coverage (%)	99.4	85.0	76.2	90	99
4G Population Coverage (%)	77.6	36.8	51	36.7	99

Source: Author's calculations based on ITU (2017) and GSMA (2018) data

---

38 Price basked methodology available at: https://www.itu.int/en/ITU-D/Statistics/Pages/definitions/pricemethodology.aspx

Whereas network coverage gaps in South Africa are closing, the digital divide is increasingly characterized by unaffordability of internet use[39]. In 2019[40], the Competition Commission of South Africa in 2019 found that the current data prices are excessively high, noting that existing competition in the sector has not been sufficient to push prices down. Based on Research ICT Africa's[41] Mobile Pricing Index Portal the cheapest mobile 1GB data product on the market in Q3/2019 cost US$ 6.81, compared with Kenya's US$ 2.44, Nigeria's US$ 2.78 and Mauritius's US$ 5.16, suggesting much room for improvement. On the other hand, based on ITU data from 2017 (Table 1), South Africa's mobile broadband data appear relatively affordable at 1GB mobile broadband data costing 1.2 percent of Gross National Income Per Capita (GNIPC), well below the UN Broadband Commission target of 2%. Based on this measure, South Africa performs well against Kenya and Nigeria, but is far more expensive than Mauritius. Also, ICASA in 2018 found that South Africa's data costs fall in the mid-range of SADC and BRICS comparator countries. The final findings of the Competition Commission's Data Market Inquiry42 from December 2019 provide at least a partial way forward in terms of lowering consumer prices, as it mandated both MTN and Vodacom to reach agreements with the Competition Commission on significant price cuts.

Using data from the Statistics South Africa's Living Conditions Survey 2014/2015, and the ITU prices for 1GB of mobile broadband data from 2018 , the bottom 20 percent of South Africa's population would have to spend around 12 percent of their income per capita for 1GB of mobile data (Figure 6), a figure much higher than the ITU average. Geographical analysis shows that South Africans living in rural and informal areas face substantially higher data prices as a percentage of their income per capita, as do demographic groups of blacks and women, in which poverty levels are higher. Results from a 2017 Survey by Research ICT Africa[43] point out to a 36 percent gap between rural and urban internet use in South

Figure 6: Price of 1GB of data as a percentage of income per capita by income type
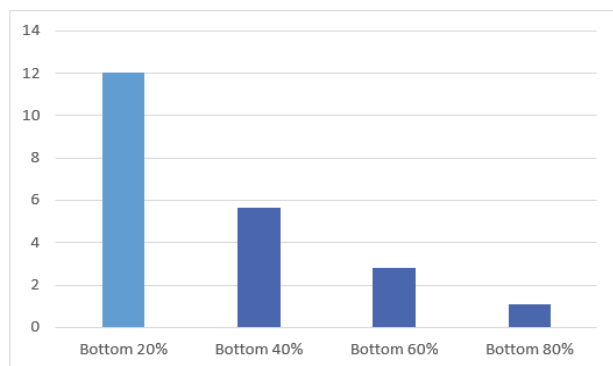
Source: Author's calculations based on the Living Conditions Survey

Figure 7: Price of 1BG data as a percentage of income per capita by geography
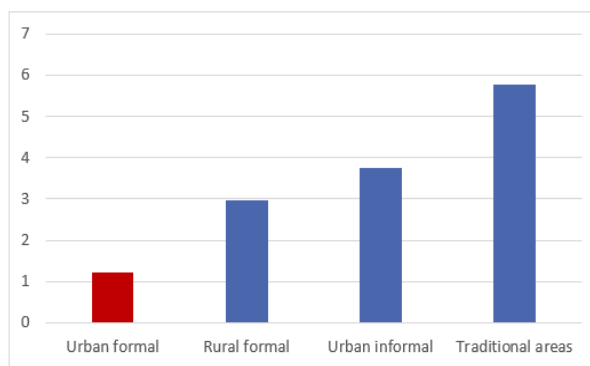
Source: Author's calculations based on the Living Conditions Survey

---

39 Based on the RIA survey from 2017, the majority of those not connected to the internet belong to the lowest two income quartiles (earning less than ZAR 7167 per month) and are disproportionately located in rural areas

40 Data Services Market Inquiry. Provisional Findings and Recommendations. Competition Commission of South Africa 2019.

41 https://researchictafrica.net/ramp_indices_portal/

42 Data Services Market Inquiry. Final Report.. Competition Commission of South Africa 2019.

43 Research ICT Africa (2019)

Africa, which may at least partially be explained by unaffordability of use. There are structural issues with pricing that work against poorer consumers: postpaid data is cheaper than prepaid, and people with less disposable income also end up buying smaller data bundles, which are costlier than large ones.

2.2.2. First Mile: South Africa's International Connectivity

For a long time, international connectivity formed a major bottleneck in South Africa. Until 2009, Telkom enjoyed monopoly on the submarine cables connecting South Africa to the rest of the world and input prices for local internet service providers (ISPs) were high. Today, there are five submarine cable systems landing on both East and West coasts of South Africa with more planned to come online in the next years[44]. Together with an open and competitive international connectivity market this has resulted in significant reductions in bandwidth prices[45]. Based on ICASA operator surveys, the total used international internet bandwidth increased by 61.7% from 2016 to 2017 and by 41.6% from 2017 to 2018 and was around 0.87 Tbps in 2018[46]. South Africa has open international gateways to all its neighboring countries.

Figure 8: Growth in international internet bandwidth (Mbps per second) [47]
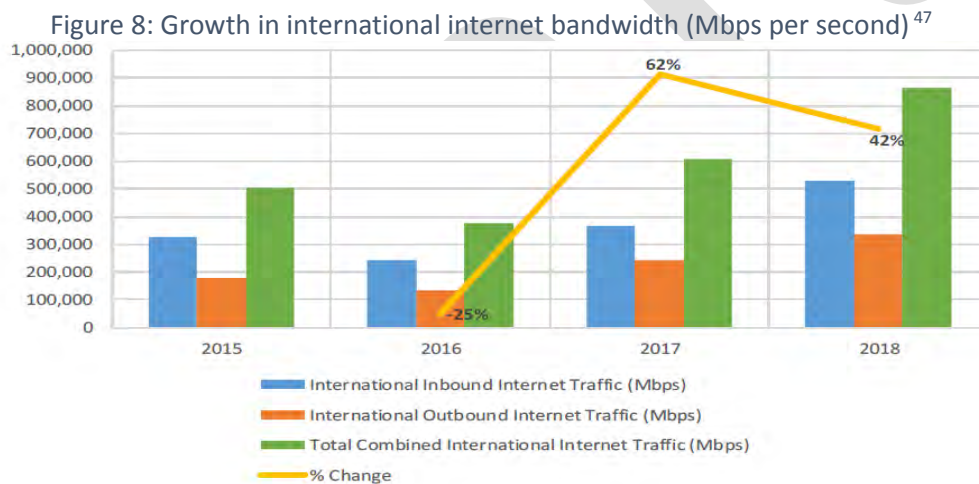
Source: ICASA Electronic Communications Questionnaire 2018

2.2.3. Middle Mile: National Backbone Infrastructure

South Africa has the most extensive backbone infrastructure on the African continent. The market has been liberalized since 2005 and has seen an expansion of infrastructure providers since. Overall, South Africa is estimated to have around 200.000km of fiber deployed of which a little over 100.000km in long-distance transmission[48]. By far the largest network is owned by Telkom's Openserve wholesale subsidiary (over 150.000km in total of which 75.000km long-distance, passing around 300.000 homes). BBI has a network of about 15.000km of fiber and provides managed bandwidth to its customers. Main dark fiber providers include Dark Fibre Africa and Vumatel, estimated to have 20.000km of fiber deployed. Fibreco operates around 4000km and Liquid Telecom 3000km of fiber, covering main cities and towns across the

---

44 The existing cable systems include: SEACOM, EASSy, West African Cable System (WACS), Africa Coast to Europe (ACE), SAT-3/WASC/SAFE. Planned include: SABR, SAEx, IOX Cable System, Africa-1, and METISS

45 According to Telegeography market data, the price of a 100 Gbps IRU between Johannesburg and London has come down from US$87 million to around US$3,97 million between 2013 and 2018

46 Telegeography estimates are much higher than the ICASA statistics, pointing to 3.39 Tbps in Q4 of 2018.

47 Values for the 12-month period ending 30 September

48 This part based on Competition Commission 2019, Operators' reports, Research ICT Africa 2018

country. Main MNOs have their own long-distance transmission networks and municipal fiber networks exist in some towns and cities.

SANREN is South Africa's national research and education network connecting academic institutions and campuses[49]. It is operated by The Tertiary Education and Research Network of South Africa (TENET) on a non-profit basis under a collaboration agreement with the Council for Scientific and Industrial Research (CSIR). The network is specifically important for running big science projects at universities and research institutions. For example, it provides national and international connectivity for the flagship Square Kilometer Array (SKA) project.

Overall, the fiber-optic backbone infrastructure has grown increasingly robust, albeit concentrated in more urban areas. Already in 2013, it was estimated that 86% of SA population in 2013 resided within 10km of fiber, after which deployments have expanded significantly. There are six active Internet Exchange Points (IXPs) in the three biggest metro areas of Johannesburg, Cape Town and Durban, the largest IXP in Africa ranking within the top 15 globally[50].The main challenges with the middle mile are related to duplication of infrastructure and rural reach. The government has a strong presence on the market through its ownership in Telkom and the fully state-owned BBI[51]. As the market has showed it is capable to deploy infrastructure to largely meet South Africa's growing needs, privatization of government-owned assets combined with stronger regulation of the wholesale market could be considered.

2.2.4. Last Mile: Reaching the End-Users

In South Africa, Mobile Network Operators (MNOs) have played an important part in providing connectivity throughout the country. The last mile in South Africa is mostly built, operated and dominated by the four main MNOs: Vodacom South Africa, MTN South Africa, Cell C and Telkom Mobile. In addition, South Africa has a recent market entry of the data-only operator Rain and a growing number of MVNOs. Based on latest ICASA data, mobile broadband network coverage was 99.5% population coverage for 3G and 85.7% for 4G in 2018, the latter going up significantly since 2017 (Figure 9) and compared to ITU data from 2017 (Table 1). The Digital Economy for Africa Initiative's target of 100% mobile broadband coverage by 2030 is virtually reached.

---

49 https://www.sanren.ac.za/ Currently the network tracks 1031 sites connected.
50 https://www.teraco.co.za/news/napafrica-ixp-ranks-top-15-globally/
51South Africa Connect. Creating Opportunities, Ensuring Inclusion. South Africa's Broadband Policy. 2013.

Figure 9: National population coverage for 3G and 4G
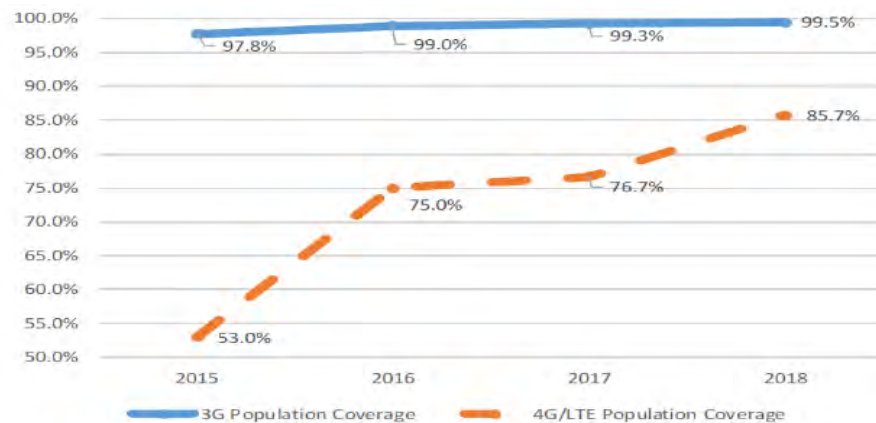
Source: ICASA Electronic Communications Questionnaire 2018

Quality of Service (QoS) in South Africa is regarded as poorer than in many other comparable countries[52] and network performance can vary greatly across the covered areas. Delays in spectrum auction have limited the operators' ability to expand their 4G networks and provide faster speeds on existing networks. Spectrum allocations per operator are considerably low by international comparisons. South Africa is first in Africa for average mobile download speeds, but performance varies in different provinces, with speeds in the fastest province (Free State) was 38.7% faster than that in the slowest (Northern Cape)[53]

There is an estimated 28 000 cellphone towers in South Africa as of mid-2018[54]. Although the majority of these are owned by the two biggest MNO's Vodacom and MTN, they are also built and operated by independent Towercos or in-house tower business units like in the case of Telkom's Gyro Towers. Altogether there are 11 independent Towercos on the market, owning around 1/3 of South Africa's tower infrastructure. The passive infrastructure market is expected to grow as operators divest from their own tower infrastructure.

Fixed-line internet and especially fiber-optic connections to homes and businesses (FTTX) have experienced rapid growth in recent years (*Figure 3*) on the back of the expanded long-distance and metro area open access fiber infrastructure. This has led to duplication of infrastructure in metro areas, but on the other hand has promoted competition and opened opportunities for smaller ISPs. The higher speeds and reliability that DSL and FTTX connections provide are important for the growth of the digital service market. There are signs emerging of operators looking to expand affordable fiber connections also to lower income township markets[55].

In addition, South Africa has several commercial operators and non-profits utilizing unlicensed spectrum for providing community-level local internet connectivity. South Africa is the only country in the region to

---

52 Alternative fiber-optic infrastructure is owned and developed by both Eskom (South Africa's public electricity utility) and Transnet (Public operator of ports, railways and pipelines). BBI enjoys exclusive servitude access to these assets.
53 Based on the GSMA Mobile Connectivity Index
54 www.towerxchange.com Issue 23 2018
55 http://businessmediamags.co.za/business/made-in-sa/is-fibre-lighting-up-the-townships/

have published TV whitespace regulations[56], but progress on exploiting the frequencies commercially has been slow.

2.2.5. Invisible Mile: Key Policy and Regulatory Issues

The Government has viewed the current regime of infrastructure competition among MNOs as ineffective, arguing it has resulted in high prices, much infrastructure duplication and an urban bias. Driving down data prices through stronger regulation and more competition has become a political priority[57], but also a regulatory problem, reflected in the Competition Commission's inquiry into the data markets and ICASA's parallel mobile market review. The proposed Electronic Communications Act (ECA) Amendment Bill of 2018 was designed, among others, to give smaller MNOs better means of accessing high-demand spectrum, encourage more service-based competition and lower data prices. The Bill was withdrawn in early 2019 and its re-introduction and adoption of the legislation has been postponed.

One of the key proposals in the Amendment Bill was to establish a Wireless Open Access Network (WOAN) operator in the wholesale market. Through the WOAN, The Government's objective was to promote more efficient spectrum use and service-based competition for achieving more affordable rates for consumers. The model has experienced much opposition from the market, especially from most of the existing MNOs. The Council for Scientific and Industrial Research (CSIR) in a study[58] commissioned by the DTPS confirmed the model's feasibility in terms of available spectrum, recommending that 20% of the available high-demand spectrum be assigned to the WOAN. It also noted the need to carry out a proper market study on the model, which to date has not been done. The Competition Commission in its preliminary findings[59] concluded that the model could increase market competition if correctly structured: it needs to be an effective competitor in the wholesale market instead of a monopoly in any part of it, and requiring vertical separation if operated by an existing MNO.

Despite repeated calls for releasing more high-demand spectrum for 4G use, the process has been subject to substantial delays. The slow progress has created much concern in the market, restricting the operators ability to expand and upgrade their existing networks and to prepare for the introduction of next generation 5G networks. Even though 5G will likely not play a major role in advancing rural access and quality of service, it will play a major part in promoting South Africa's international competitiveness, ensuring continued private investment in the sector and promoting innovation in the digital economy. Through a Policy Direction issued on July 26 2019[60], the DTPS mandated ICASA to proceed with the WOAN licensing process as well as assignment of high-demand spectrum to other operators. This has been widely regarded as a positive step. After the withdrawal of the ECA Bill, the licensing process will be carried out under the existing licensing regime, guided by the ICT White Paper of 2016 and the Policy Direction. ICASA issued an information memorandum on the licensing process in November 2019[61] and plans to issue an Invitation to Apply (ITA) in 2020. Constraints still remain: the available spectrum is fragmented, and some

---

56 Innovative Business Models for Expanding Fiber Optic Networks and Closing the Access Gaps. World Bank. 2018.
57 For example, ICASA introduced new rules in April 2018 that specified that operators are not be allowed to charge consumers out-of-bundle rates for data when their data has run out without consumers' prior consent.
58 CSIR (2018)
59 Data Services Market Enquiry. Provisional Findings and Recommendations. Competition Commission of South Africa 2019.
60 Electronic Communications Act (36/2005) » Policy on High Demand Spectrum and Policy Direction on the Licensing of a Wireless Open Access Network. July 26 2019
61 ICASA 2019b

of the identified spectrum in the 700Mhz and 800Mhz bands is still occupied due to the unfinished digital migration process.

Whereas market players interviewed for this study did not raise any major problems related to the current infrastructure sharing regime, some challenges remain. All licensees are required to provide access to facilities on negotiated terms (except if technically and financially unreasonable), but in practice incumbents have often refused access. There are also complaints that gaining permissions from local governments and utilities to deploy broadband infrastructure is expensive and complex. The Amendment Bill was to introduce stronger enforcement around infrastructure sharing, moving to impose ex-ante sharing obligations to vertically integrated operators. It also aimed at establishing a national center to support rapid deployment and necessary permits. Stronger regulation on infrastructure sharing could present an alternative to the WOAN through lowering barriers of entry to the market.

South African cybersecurity, data protection and privacy policies have been proactive compared with many African peers. The Protection of Personal Information Act of 2013 (POPIA) is well in line with international standards and the Constitution of South Africa provides for strong privacy protection. The National Cybersecurity Policy Framework passed in March 2015 focuses on improving institutional coordination, cybersecurity functions, infrastructure and information flows across sectors. In organizing for cybersecurity response, South Africa has employed a distributed model, where the national Cybersecurity Response Committee (CRC) and the Cybersecurity Hub coordinate several sectoral Computer Security Incident Response Teams (CSIRTs). There has been some legal progress, but implementation of the framework has not been as fast as hoped.

2.3. RECOMMENDATIONS & NEXT STEPS

The overall state of South Africa's digital infrastructure is relatively robust and has enabled progressively better market outcomes for consumers. The challenges have moved from expanding network coverage to ensuring access and affordability through regulating an increasingly populated and complex market. Going ahead, South African policies should aim at universal internet access, ensure competitive broadband markets, alleviate concerns around mobile spectrum capacity, improve network performance, promote rural connectivity and stimulate fixed-line adoption.

South Africa needs an updated national broadband policy with realistic targets and implementation models based on international best practice. It should aim for universal fast internet access during the next decade in line with the Digital Economy for Africa Initiative. Instead of continuing to rely on SOEs, grant or guarantee mechanisms to subsidy private sector investment could be considered to incentivize infrastructure roll-out. The Government should also use its anchor position on the market more proactively to stimulate competition, through aggregating its demand for connectivity and have this delivered on a competitive basis. These measures would help attract more private interest into underserved areas.

Ensuring ICASA's independence and capacity under the new merged national department is key. The regulator needs clear mandate confirming its field of play, to help alleviate concerns around its independence and expedite stalled actions such as spectrum licensing. The regulator should also have

sufficient budget resources. The ECA Amendment Bill's proposal for enhancing coordination between ICASA and the Competition Commission appears sound.

The government should prioritize fast-tracking spectrum assignment, to increase network capacity and alleviate constraint that the operators currently face and to take a proactive stance towards next generation 5G networks, to promote South Africa's international competitiveness. The DTPS Policy Direction and the ICASA Information Memorandum in 2019 have been good steps towards this direction. Allowing sharing of spectrum as part of the licensing process, and trading of high demand spectrum if there is no detrimental impact on competition could be considered.

In the WOAN licensing process there needs to be careful consideration of the model to avoid monopolistic outcomes in the wholesale market, maximize private investment and ensure continued incentives to innovate. Although there is room for improvement in mobile competition, it is not clear that the WOAN would solve issues around market competition in the short term.

South Africa should make efforts to encourage further positive developments in the fixed-line broadband market. Promotion of infrastructure sharing, pro-competition open access principles, implementation of transparent wholesale pricing and determination of regulatory remedies could help the market grow. A possible market enquiry into the wholesale market by ICASA could be beneficial to guide these steps.

Ensuring effective access to civil infrastructure such as ducts and poles held by incumbents can have significant potential for promoting competition and further investment in South Africa. Stronger enforcement of the country's existing infrastructure regime and new rules around infrastructure sharing might also be needed to lower costs for new entrants, backed up by more coordination for rapid deployment as proposed by the ECA Amendment Bill.

The USAF of South Africa currently administered by USAASA (and to be integrated into the DDF) should be redesigned to better promote expansion broadband access in the country and innovation in the digital sector. Incentives for de-risking private sector investments in rural areas and accelerating deployment of high-speed fiber in peri-urban areas could be part of the mix, as could be demand-side schemes for subsidizing low-income consumers' communication costs as a more economic option to supply side subsidies. Innovative use of unlicensed spectrum (Wi-Fi, TV whitespace) could be further supported.

3. PUBLIC DIGITAL PLATFORMS

3.1. BACKGROUND AND IMPORTANCE OF PUBLIC SECTOR DIGITAL PLATFORMS

Digital public platforms serve as an important enabler of digital economy that allows both public and private sector organizations to come up with new or better outcomes for citizens. The discussion of digital public platforms is often equated with the development of e-government or digital government. While the level of digitalization of government is an important reflection of the state of the development of the digital public sector platforms, the core platform components are more foundational. First, they include *facilitation of secure transactions between people and institutions* – through digital ID systems and trust services. Second, it is the *facilitation of data exchanges leveraging common resources* – through interoperability and shared services; and finally, the *interface through which governments engage with the public* – through digital service delivery and applications of core government functions. This chapter discusses the current state of these core components of digital public platforms in South Africa and provides recommendations for their further development.

South Africa is one of the leaders in the region - second only to Mauritius in Africa - based on the UN's 2018 e-Government Development Index (EGDI) (Figure 10). Only four African countries (Mauritius, South Africa, Tunisia and Seychelles) are in the top fiftieth percentile along with countries that have EGDIs above the world average of 0.549. South Africa's EGDI is 0.66 (ranked 68th out of 193) with a high online service index (0.83) and human capital index (0.73), and a lagging telecommunication infrastructure index (0.42). On the other hand, citizen participation index (0.85) is very strong, where South Africa is ranked 39th in the world.

Figure 10: EGDI overview of South Africa[62]
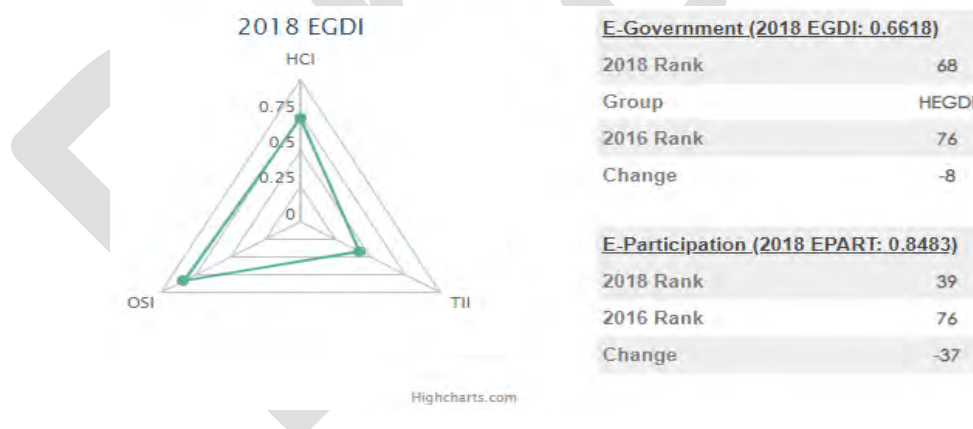
Source: United Nations (2018) e-Government Survey

The government adopted the National e-Government Strategy and Roadmap in November 2017 to guide the country's digital transformation. The Strategy identifies three e-Government strategic thrusts: (1) e-Government Services Transformation: Standardized national e-services portal; (2) Enhanced e-Governance: Shared platforms, open government, improved governance; (3) Digitally-enabled Society: Digital literacy for citizens, service centers.

---

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

Although the activities outlined in the Strategy are in various stages of implementation, the funding appears to be a challenge. This shortcoming requires urgent attention so as not to lose the momentum, at the onset of important initiatives planned for 2019. As important as the scarcity of funding is the shortage of human capacity for implementation. This concerns both the stock of skilled IT professionals as well as the need for constant updating of their skills.

Given the above context, this chapter examines the building blocks for public sector digital platforms to uncover enabling conditions and bottlenecks for the further development of the platforms. These building blocks include: (i) institutional setup for digital government development and management; (ii) data policy and frameworks; (iii)   interoperability, back-office systems, and shared systems; (iv) digital ID; and (v) digital service delivery.

These building blocks are tightly interconnected. Institutional setup and leadership underpin the coordination of digital government initiatives. This, in turn, depends on the legal and behavioral norms regarding sharing the data among the Departments and Agencies and the public at large. Coordination and data exchange further enable or hinder the creation and operating of the shared systems, as well as ensuring the interoperability among the systems of Departments and Agencies. Creation of shared systems and ensuring interoperability also depends on how much of the government back-office operations are digitized in the first place. At the interface with the public, the digital ID services are crucial to ensure trust and facilitate secure transactions. Finally, all of these issues impact the ability of the government to provide digital services to its citizens.

Because of the government structure in South Africa, the assessment at the national level can only paint a partial picture of the state of the government digital platforms. Because many of the key services are provided at the provincial level, much drive for the government digital innovation happens there. Although a full subnational analysis was beyond the scope of this rapid assessment, the discussions with the national-level institutions were supplemented by a selective examination of the public sector digital platforms in two provinces: Gauteng and Western Cape. There is a consensus that these two provinces are generally at the forefront of developing digital government solutions in South Africa and thus capture the biggest advances at the provincial level.

3.2. DIAGNOSTIC FINDINGS: CURRENT STATE OF PUBLIC DIGITAL PLATFORMS

3.2.1. Institutional setup for e-government development

There is a great fragmentation and proliferation of institutions at the national level responsible for various platforms and ICT services. The main institutional players include the following:

- Department of Public Service Administration (DPSA). The overall responsibility for public sector innovation is vested in the Minister for the DPSA. It includes the Center for Public Sector Innovation (CPSI), whose mandate is to "to entrench the culture and practice of innovation in the public sector in its entirety."
- Department of Telecommunications and Postal Services (DTPS). The above-mentioned National eGovernment Strategy was developed by the DTPS. The DTPS was founded in 2014 to focus on "modernizing the economy and economic infrastructure to bring the cost down through the roll-

out of Broadband, e-Government, Cybersecurity, Postal, and Postbank services." The DTPS is expected to be the facilitator and catalyst for the implementation of the Strategy.

- Department of Science and Technology (DST). DST, along with DTPS and DPSA, is responsible for some parts of the strategy dimension, including producing innovation strategies (somewhat overlapping with those produced by DTPS and DPSA) and ICT Roadmap.
- Department of Home Affairs (DHA). DHA manages the Government's Home Affairs National Identity System (HANIS), which is being upgraded transformed into the National Identity System (NIS) as a digital identity system to facilitate electronic transactions online, among other improvements.
- State Information Technology Agency (SITA). SITA, originally formed within DPSA, was detached from DPSA and attached to DTPS for the procurement of IT services, standard setting and products authentication, security of government data, and provision of e-government services. SITA is expected to work together with DTPS and DPSA in providing project management and other support to all e-Government projects for the delivery of government services especially at national and provincial levels.
- The Office of the Government Chief Information Officer (OGCIO) and the Government Information Technology Officer's Council (GITOC). OGCIO and GITOC were established by regulations that came into effect in 2003 under the umbrella of the DPSA. Both aim to bring value to government in terms of ICT use for internal administrative applications and general government service provision to citizens and businesses alike.

This institutional fragmentation leads to coordination and collective action problems, with many blurred, overlapping, and sometimes undefined responsibilities. Following the organizational changes introduced in 2014, the DPSA and DTPS have focused on relevant parts of the e-Government agenda. However, coordination of efforts has been difficult due to multiple regulations and less than clear allocations of roles and responsibilities, despite progress made over the past few years. World Bank (2019) mapped the roles and responsibilities of the various actors in the e-Government space to the EU e-Government framework used by all 34 EU member and candidate countries.[63] This comparative analysis (Figure 11) identified several overlaps and challenges with these roles. Critically, coordination role itself is not clearly defined, with DTPS de facto filling this space and assuming this role at times. Going forward, it would be important to clarify the specific role of each key entity to minimize coordination and communication challenges.

---

[63] World Bank 2019: Unlocking Innovation in South African Public Service

Figure 11: Mapping of new governance model to EU e-government model

Policy / Strategy

Coordination

Implementation

Advisory / Tech Support

Data Protection / Security

Audit / Oversight

Source: World Bank 2019: Unlocking Innovation in South African Public Service

The institutional picture looks more cohesive at the provincial level, at least in the two leading provinces: Gauteng and Western Cape.

- Gauteng is the only province in South Africa that has a dedicated Department of e-Government, established in 2015. Formerly a Shared Services Center (SSC) within the Department of Treasury, the Department of e-Government has been building credibility by focusing on change management, specifically changing the internal culture and behavioral norms, fashioning itself as a service center and creating a client-oriented culture toward other provincial departments. Its mandate is the implementation of the Gauteng e-Government Strategy, approved at the beginning of the provincial administration that covers a comprehensive space including digital infrastructure, skills, cybersecurity, big data, and development of e-services, including a single platform (electronic one-stop shop).
- The Western Cape. Like in most other provinces, the e-Government agenda in the Western Cape is driven from the Office of the Premier. The Western Cape Office of the Premier houses a sizeable ICT unit that includes four key directorates and employs about 300 full-time staff and additional 120 contractors. The Premier's ICT unit is responsible for the implementation of the provincial Digital Government Strategy and relies on the ICT units and ICT champions in all provincial departments. The Western Cape Digital Government Strategy is similarly comprehensive as in Gauteng, and includes infrastructure and connectivity, service delivery, information security, data governance, and digital empowerment of both citizens and government employees.

3.2.2. Data policy and frameworks

There are several aspects to the data building block for government digital platforms. On the one hand, there is a question of protection of personal privacy; on the other, there is a push for information sharing and transparency to citizens at large. At the same time, data protection and privacy is not about information being confidential, but rather about the data subjects having consent and control over their data, and data controllers and processors taking appropriate responsibility to secure personal information. This tension between privacy and transparency is again shaped by legal, technical, behavioral, and political economy aspects. However, the underlying premise is that if the privacy of

personal information is protected, there are sizeable benefits of data sharing among the departments and agencies for the benefits of citizens. Data sharing can reduce costs of service delivery: citizens only need to be contacted once; citizens do not need to furnish the data to one agency that another agency already has on file; and in addition, more transparency improves the ability of citizens to monitor and provide feedback on service delivery. A related aspect is the government's capacity to process data and utilize data analytics for policy making, especially in the rapidly evolving world of the big data.

RSA has a Protection of Personal Information (POPI) Act, parts of which recently became effective with appointment of a new Information Regulator. POPI sets out conditions to lawfully process the personal information of data subjects (people and firms). The POPI Act does not require the Departments and Agencies that process personal data to get consent from the data subjects; however, Departments and Agencies information processors are responsible for complying with the POPI conditions. If Departments and Agencies outsources processing, it is also responsible for a failure by their contractors to meet the conditions. The biggest compliance burden is therefore borne by the citizen-facing service-delivery Departments and Agencies that process personal information, such as Departments of Home Affairs or Department of Health.

On the other side of the equation, the open data policy at the national level is driven by the Open Government Partnership (OGP). In its OGP Action Plan, South Africa has committed to developing a pilot national open data portal and consolidating various datasets from across the three branches of government. The main objective is to enable citizens and businesses to easily access government published data. Aside from increasing transparency and accountability, the objective of the portal is also to allow for the development of user-centric applications utilizing data published on the portal. DPSA was the main implementing institution, with support from Government Communication and Information Services (GCIS), Innovation Hub, DTI, and firms and CSOs (OpenUp, Microsoft, Chillisoft). After the piloting phase and early results in 2016, the permanent Portal is currently in its beta testing version. *"The pilot national open data portal and hackathons opened government's eyes to new possibilities of collaboration around open data and has successfully served as the basis for the further development of a permanent open data portal," according to the OGP report. Moreover, "locally, many metropolitan municipalities (Cape Town, Ekurhuleni, Johannesburg, and eThekwini) are in initial discussions for establishing open data portals and/or hosting hackathons. This is evidence of growing interest in using open government data to solve government problems and foster innovation and entrepreneurship."* (OGP Annual Report 2017)

The government has some capabilities for data analytics, but big data use is still an area of growth. A behavioral change is taking place within all levels of the government stemming from the understanding that data needs to be taken more seriously than in the past. Hackathons are increasingly popular to come up with new solutions for public sector problems. Within the Departments and Agencies, CPSI is incentivizing innovative data analytics, including visualization and infographics, through CPSI annual Public Sector Innovation Awards that focus on innovative ways to improve service delivery and evidence-based decision-making. The demand from policy-makers is growing, hence these capacities are being developed at a faster pace.

At the provincial level, there is a similarly upward trajectory for the demand for data analytics and utilization of big data.

- Gauteng. Big data analytics are part of the provincial e-Government strategy. Because Gauteng is geographically smallest but demographically largest while also enjoying a relatively high level of development, the province can entice private sector and national government support to pioneer big data approaches. There are currently three big data projects in the province (education, treasury, and Office of the Premier) being implemented through PPPs (including with Microsoft and local companies and academic institutions). Demonstration effects are expected within three years.

- Western Cape. The provincial government has pursued a goal of data-driven service delivery and decision-making. It has become very capable at collecting the data for monitoring but is still ramping up its capacities to analyze and act upon the data. This requires a certain shift in the mindset that was spearheaded by the Western Cape Delivery Support Unit (DSU) in the Office of the Premier. DSU's trademark has been very strong data analytics to drive the implementation of Premier's priorities (game changers), which has had a demonstration effect for other Departments and Agencies.

3.2.3. Interoperability, Back-office systems, and shared services

Because interoperability relates to data and process sharing among Departments and Agencies, it involves technical, legal, and behavioral aspects. South Africa has a recently-updated national-level policy document on interoperability. The basic premise is that because all IT procurement is centralized in SITA, the procured systems should by design adhere to a minimum interoperability standards (MIOS). However, in practice this is not always the case. Sometimes there are technical reasons, such as legacy systems that precede SITA and MIOS; at other times, there is a lack of connectivity at the last-instance service delivery point (e.g. maternity ward) that prevents accessing a more centralized database (e.g. Department of Home Affairs and birth registrations).

In theory, the OGCIO coordinates through GITOC to ensure the MIOS; however, this does not always result in interoperability in practice. There are also legal and legislative hurdles that prevent exchange of data among Departments and Agencies, including the POPI Act that limits the ability of departments to share information. Some of these issues are also behavioral, where there is reluctance to share information that may be a source of power or revenue. At the technical level, there is no concerted push for mainstreaming of Application Programming Interfaces (APIs) that would allow limited queries from one system to the other. The latest version of MIOS does not even refer to APIs, which suggests there may be a capacity issue relating to the understanding of the latest developments in the field. At the provincial level, there are limited legacy systems, so interoperability is easier to ensure given that most of the digital systems are new.

Key back-office systems are mostly digitized in South Africa at the national level. This includes the transversal systems, such as financial management, payroll and procurement. SITA is responsible for the maintenance of these systems, even if some of them have been developed with the assistance from private sector, often decades ago. National Treasury is the owner of these key systems and the driver of the reform. Crucially, however, the transversal systems are not fully integrated and are becoming outdated. The beginnings of integration efforts date back to 2003 and have still not been completed. The transversal systems are shared between the national and provincial levels. At the provincial level, there is still a preponderance of manual systems in health and education, mainly due to the limited broadband availability at the level of schools and clinics.

There is no single Electronic Government Procurement (e-GP) system in South Africa covering a comprehensive end-to-end processes of procurement system conducting procurements using functions and tools online, except the publication of transversal procurement (like a Framework Agreement) in g-Commerce portal, which is already in use. In April 2015, the Office of the Chief Procurement Officer (OCPO) launched the e-Tender Publication portal and the Central Supplier Database (CSD). National and provincial departments publish their tenders in accordance with the demand plans for acquisition of goods, services and infrastructure. The e-Tender portal was the first step towards implementing government's e-GP system as part of the Integrated Financial Management System and directly contributed to reducing duplication, fragmentation and inefficiency in government tender publications. However, it would be advisable to implement the end-to-end e-GP system covering all procurement processes addressing all the dimensions of public procurement good governance dimensions like transparency, accountability, efficiency and effectiveness, equity, rule of law, predictability, citizen engagement and value for money for socio-economic development.

Shared or common ICT services are a growth area at both national and provincial levels. Nationally, as of April 1, 2019, SITA was expected to launch South Africa's first government cloud (gCloud) platform. SITA partnered with private sector companies (Gijima, IBM and Huawei) to develop gCloud. Departments of Higher Education and Training, Department of Labor, National Space Agency, and Gauteng provincial government are among the early adopters, and have relocated their storage and hosting from data centers to the gCloud. Introducing gCloud as a shared service for Departments and Agencies will contribute not only to modernization, capability and improved services, but also to government business continuity.

In addition, at the provincial level, there is further push toward common ICT services. These efforts focus as much on the technical part of the issue as well as on the change management requiring behavioral changes, including building trust in centrally provided systems.

• In Gauteng in 2018, provincial Cabinet approved the centralization of five functions in e-Government department: broadband, SAP enterprise resource planning, Microsoft licensing, Security Operations Center (SOC), and data center services.
• In Western Cape, some of the shared services include: the provincial project management system (Microsoft-based); internal data governance; and client relations management. There is also a shared website for all provincial departments maintained centrally; however, updating is a challenge as it is not an ICT issue but rather a communication strategy issue. Western Cape is also at the forefront of integration of the transversal systems (FM, payroll, procurement), although the effort is driven nationally by the National Treasury.

3.2.4. Digital Identity

Trust in a person or entity's identity is critical for the ability of governments, firms and citizens to engage in various transactions, including service delivery. Official forms of identification, e.g. ID cards, birth certificates and passports, have traditionally served this purpose, but the emergence of the digital economy has necessitated verifiable digital identity credentials. Digital ID systems facilitate the secure identification and authentication of a person, entity or device—both in person and/or online—and bind the user of an online transaction with their "real world" or legal identity. Combined with digital certificate services (e.g., public-key infrastructure or PKI), they are also the basis for e-signatures, which enable knowledge, approval, acceptance, or obligation to be indicated without physical presence.

South Africa has a strong identity ecosystem comprising digitized and fully-integrated national ID and civil registration systems, which are built on a comprehensive national population register.[64] The Department of Home Affairs (DHA) is responsible for maintaining these systems, including the provision of registration and related services through 574 offices at regional and district levels, and mobile units that travel across the country. The national ID system is known as the Home Affairs National Identification System (HANIS), and it includes fingerprints for biometric authentication and deduplication. Since 2013, DHA has been replacing expired green barcoded ID books with a national ID smartcard, which is expected to be completed by 2023. However, the rollout has been slow, owing to the fact that less than half of DHA offices are equipped with equipment to electronically capture fingerprints, which is a requirement for the new smartcard.

The 2017 ID4D-Findex survey found indicates that 92 percent of the population in South Africa aged 15 and above has a national ID card (either the green barcoded ID book or the new national ID smartcard, with lower levels of coverage among vulnerable populations. Combined with the current high birth registration rate, an estimated 90 to 95 percent of South Africa's population are registered. This places South Africa among the highest levels of ID coverage in the world, let alone in Africa. Two key reasons for the high coverage are: (1) that registration services are widely-accessible across the country, including in hospitals for birth registration; and (2) that the national ID and civil registration system are used for public and private sector service delivery, therefore generating demand for and value in these systems. Crucially, the DHA has committed to addressing disparities in coverage among vulnerable populations such as migrants and refugees.

Usage of the national ID system for identity authentication is largely limited to face-to-face transactions, except for some banks having access (in some cases for a fee) to remotely verify information against the HANIS for customer onboarding. This service through HANIS have enabled users to reduce fraud and administrative costs, such as eliminating staff time needed to manually validate ID documents. In 2016, the Minister for Home Affairs speculated that approximately R322 million was being saved per month[65]. It is noteworthy, however, that few other sectors have the opportunity to leverage the HANIS for identity verification services, which points to a conclusion that the full impact of the HANIS is not necessarily being realized.

The DHA is in the process of transforming itself, including to replace the HANIS with a National Identity System (NIS) that will support digital identity and authentication, which are prerequistes for trust in the digital economy. A policy white paper on the repositioning of DHA was released for public comment in early 2019.[66] The white paper acknowledges that the DHA has an opportunity to accelerate South Africa's development by introducing a NIS that would be a platform that enables trusted electronic transactions online, as well as underpin smarter digital government. However, it is notable that the white paper does not consider alternative models to a centralized digital identity system, such as a federated model as what operates in the UK and Scandinavian countries, and is emerging in Canada, Thailand and several other Asian countries. Such federated models work best in countries with a dynamic private sector who can act as third party digital identity providers (along with public sector entities such as DHA) and a strong capacity to regulate and supervise those digital identity providers, which, it could be argued, South Africa possesses.

---

64 World Bank, 2019. South Africa Identification for Development (ID4D) Case Study.
65 Banks fight fraud with home affairs system, https://www.itweb.co.za/content/APero3qZe9AMQb6m
66 Department of Home Affairs, 2019. White Paper on Home Affairs. http://www.dha.gov.za/files/dhawhitepaper.pdf

An important opportunity exists for South Africa to introduce a new digital identity system that will drive inclusive growth of the digital economy and facilitate cross-border transactions (both within Africa and abroad), and could be a model for other countries. Crucially, South Africa has what many other countries, particularly in Africa, lack: high coverage and a strong existing national ID system (for face-to-face transactions). These are assets that can be leveraged to effectively build a digital identity layer on top, whether centralized or federated. In order to be successful, the NIS should be designed as a platform and with interoperability in mind, and digital identity should be seen as a whole-of-government issue and not one exclusively for DHA to solve, which is evident by the removal of "Home Affairs" from the name of the new system. For instance, there are use cases such as online land or business registration that will make doing business easier, and others such as social assistance that will accelerate efforts to reduce inequalities and poverty. Furthermore, building on the white paper, consideration should be given to exploring a federated model for digital identity in South Africa - at least in the long-term - looking to best practices from across the world, particularly related to data protection and privacy-by-design[67]. Finally, South Africa can demonstrate leadership on mutual recognition of digital identities within SADC and across Africa, which can boost regional integration and, importantly, South Africa's digital economy

3.2.5. Digital Services

Digital service delivery has received much attention in South Africa in recent years. The 2017 National e-Government Strategy and Roadmap includes a vision "to digitize government services while transforming South Africa into an inclusive digital society and economy." This national strategy encompasses several specific objectives linked to public service delivery and innovation both in public and private sector, including developing capacity and skills for effective service delivery, fostering innovation in technologies and applications to service delivery (e.g. cloud computing, big data, internet of things, mobile innovations), and transforming the way government interacts with citizens while providing services.

National e-Government Central Portal had been launched in 2018, for access to selected online services, as a part of new e-Government roadmap; however, there is currently no inventory or registry of all online services maintained by DPSA or DTPS. The UN's four-stage maturity model of e-Government has been selected to categorize online services, in line with good practices seen in many countries. SITA is expected to develop the necessary integration platform to connect each department back-end systems with the central portal (front-office) with the objective of improving the level of online services (connected services).

Because there is no single portal for digital services at the national level yet, it is not immediately possible to take stock how many services have been automated and at what level. Currently, DTPS maintains two domains www.gov.za and www.services.gov.za with different classification of the partial list of the existing digital services. However, the process of digitization and automation is quite decentralized across individual Departments and Agencies; these tend to do the work either in-house, or through SITA, or by utilizing public-private partnerships. New services and apps are added online frequently, mostly at levels 1-3 of automation. There is a growing number of mobile applications.

---

67 The ten Principles on Identification for Sustainable Development, which have been endorsed by 25 international organizations, offer a useful guiding framework of best practices. They are available at http://id4d.worldbank.org/principles

Provincial governments and municipalities have their own websites and menu of services. Provincial governments are the providers of key services such as health and education, as well as local police, agriculture, transport and other services.

● Gauteng. As part of the implementation of the provincial e-Government strategy, the Department of e-Government has developed a single online platform for service delivery by the province that was launched on May 13, 2019. However, starting already in 2018, 42 e-services went live on the new platform as a "minimum viable product." The Departments of Health, Education, Agriculture, Roads & Transport, and others are the service providers, while the Department of e-Government serves as a facilitator for the design, validation, and quality control for digital services.

● Western Cape. The current modernization efforts focus on higher levels of automation – i.e., moving towards transactions online. Western Cape adopted citizen-centric approach. This includes determining the demand for particular services that citizens would like to access online and focusing on developing the associated systems. This has led to digitizing popular services, including: (i) health - patient-doctor interface (single patient view); (ii) transport – integrated transport app with a scanning function (licensing; fines); (iii) agriculture – farm inspectors can automatically upload their reports with digital PINs; and others. In addition, citizen-centricity also involves actively pushing information and select services to citizens via online or mobile platform, rather than simple access to services.

3.3. RECOMMENDATIONS AND NEXT STEPS

The state of the digital platforms in South Africa reflects both the country's relatively advanced position on various digital government dimensions, as well as some of the bottlenecks related to their resourcing, coordination, and M&E. To achieve the Digital Economy for Africa targets for all South African citizens, the key recommendations for public digital platforms include:

First, it is crucial to adequately resource the implementation of the national and provincial digital government strategies. A consistent feedback from the implementing Departments and Agencies has been the shortage of resources for the implementation of the National e-Government Strategy and Roadmap. Reviewing the available resources at both the national and provincial level would be the first step toward making this agenda a priority, consistent with President Ramaphosa's call to use Fourth Industrial Revolution technologies to accelerate the improvement of people's lives in South Africa. If a budget shortfall is indeed identified, then fostering public-private partnerships could be one of the possible solutions.

Second, for these efforts to succeed, it will be important to improve coordination and communication among Departments and Agencies driving this agenda at the national level. The analysis in this chapter identified a fragmentation and proliferation of institutions at the national level responsible for digital government, leading to coordination and collective action problems, with many blurred and overlapping responsibilities. Coordination role itself is not clearly defined. In order to consistently drive and implement

this agenda, it will be important for the center of government to clarify the specific role of each key entity involved in the digital government at the national level.

Third, taking a holistic view of interoperability challenges will remove some of the existing bottlenecks. To achieve better interoperability, a set of interdisciplinary measures are required. First, a legal and regulatory review is needed to ensure that the Departments and Agencies are legally allowed to share data. Second, a concerted push to mainstream APIs would help to ensure that the databases of various Departments and Agencies can communicate with each other on a selective as-needed basis. Finally, an adoption and implementation of a change management strategy would allow to target behavioral constraints for further data sharing and openness.

Fourth, digital capacity building within public sector requires more emphasis. SITA provides training on the transversal systems but training on data skills, big data analytics and broader aspects of e-Government and digital platforms are lacking. Considering the role of government training institutions such as the National School of Government (also under DPSA), there is an opportunity to rethink the offerings of such institutions. Other institutions (e.g. Canada School of Public Service, Brazil's ENAP) already offer Big Data Fundamentals and Analytics and related subjects.

Finally, taking stock, monitoring and evaluating the development of digital services will greatly improve their efficiency, cost-effectiveness, and citizen-centricity. While government digital services are clearly an area of rapid development in South Africa, the process is very decentralized and seems poorly coordinated and monitored. This will ultimately constrain the uptake and efficiency of provision of these services. To this end, an entity should be identified that would take stock of all the digital services available at the national and provincial levels and monitor the number of users and transactions. This will avoid duplication and will aid in further improvement and efficiency of e-services. Eventually, it will also help to make digital service delivery more citizen-centric.

4.1. BACKGROUND AND IMPORTANCE OF DIGITAL FINANCIAL SERVICES

Digital financial services provide individuals and firms with convenient and affordable channels by which to pay, as well as to save and borrow. Firms can leverage digital financial services to more easily transact with their customers and suppliers, as well as build digital credit histories and seek financing. Governments can use digital financial services to increase efficiency and accountability in various payment streams, including for the disbursement of social transfers and receipt of tax payments. A digital financial services ecosystem requires a forward-looking and proportionate legal and regulatory framework (e.g., to allow market entry and innovation), robust financial infrastructures (e.g., national payment systems and credit reporting systems), and development and deployment of low-cost delivery channels (e.g., agents, point of sale devices, automated teller machines, mobile phones). South Africa's financial sector is adopting digitization across wide range of financial segments including payments, savings and deposit, lending, insurance and capital markets. Amongst these the payment and lending segments are most prominent and the main focus of this section.

South Africa has made significant progress on access to digital financial services (DFS), however concerted efforts are needed to further increase usage of available financial services. Despite the wide range of payment options available in the sophisticated banking system, cash remains a dominant means of payment for a large percentage of the population. Given high unemployment and inequality, the disparity between the available financial services in the advanced side of the economy and the needs of the consumers particularly in the less advanced side of the economy is significant. Government and the private sector have over the years embarked on initiatives aimed at addressing this disparity and these have included introduction of cards for social benefits, shift of government payments from cash to electronic transfer, financial products and services for the unbanked, including domestic and cross border money transfer services, airtime transfers, bill payments.

According to the 2017 Global Findex survey, 60 percent of South Africa adults (ages 15+) reported having made or received a digital payment in the past year, well above Sub-Saharan Africa average. While the 60 percent is in line with the average for middle-income countries, there is room to significantly increase usage of available financial services as shown in Figure 12.

Figure 12: Uptake and usage of digital financial services in South Africa
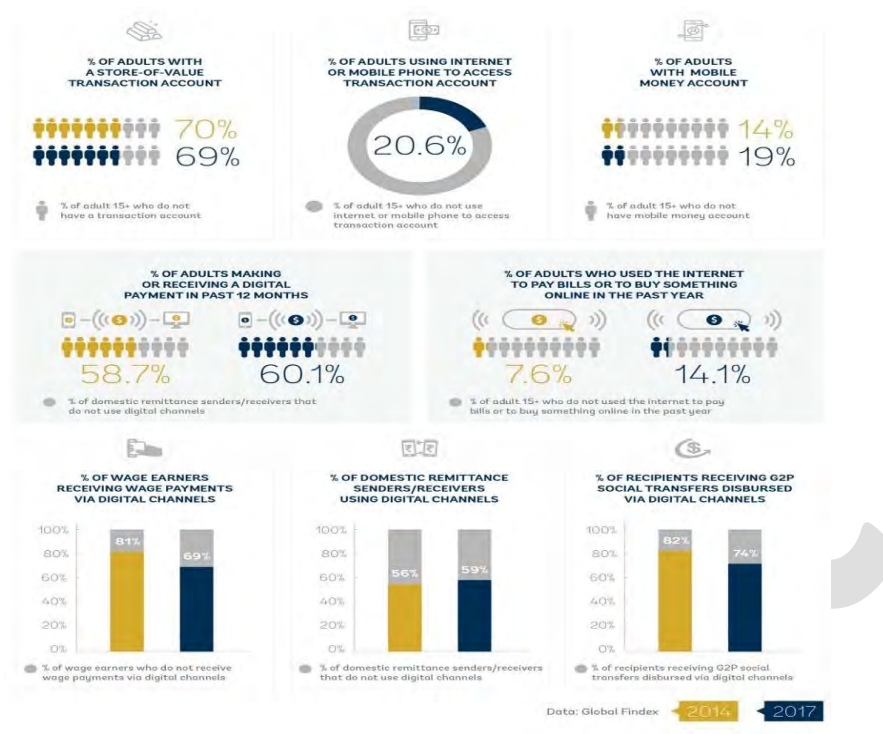
4.2. DIAGNOSTIC FINDINGS: CURRENT STATE OF DIGITAL FINANCIAL SERVICES

Account ownership among South Africans is significantly higher than in the Sub-Saharan Africa region and on par with middle-income countries (MICs). According to the 2017 Global Findex survey, 69 percent of adults (ages 15+) have an account at a financial institution or used mobile money account compared to 65 percent for middle-income countries. Compared to regional peers on account ownership, South Africa exceeds Senegal and Nigeria by a wide margin but lags Kenya. However, when compared to its BRICS peers it is on par with Brazil but lags China, India and Russia. The shift in government payments from cash to electronic transfer methods such as direct deposits to bank accounts and usage of pre-paid cards made a significant contribution to account ownership in South Africa.

Figure 13: Ownership and usage of transactional accounts for adults (percentage for ages 15+)
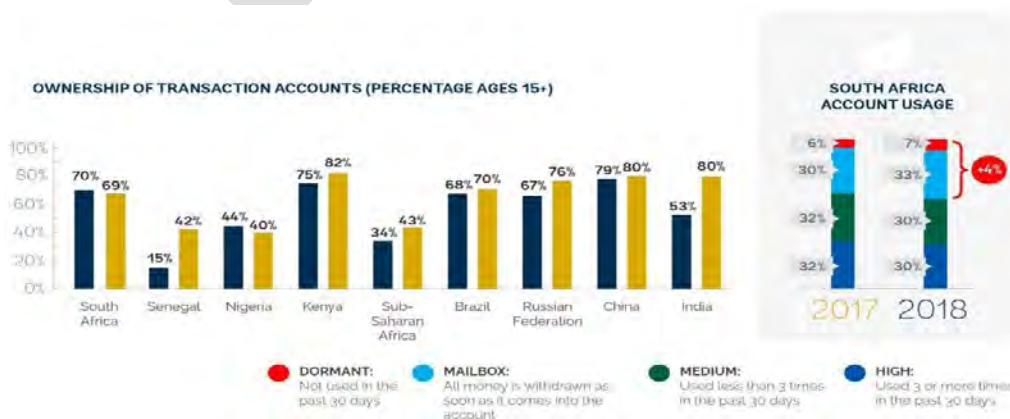
Though 60 percent of South African adults reported having made or received digital payments, the usage of debit cards (other than for cash withdrawal) and other electronic payment instruments remains low. Even among individuals holding a transaction account with a bank, 33 percent still withdraw all their money as soon as it is deposited.[68] Only 20.6 percent of adults used mobile phone or internet to access an account compared to 72 percent in Kenya and 29 percent in Senegal. Moreover, of the percentage of adults paying for utility bills, only 32 percent used an account while 64 percent used cash only.[69]

Figure 14: Adults having made or received digital payments during the past year (percentage for 15+)
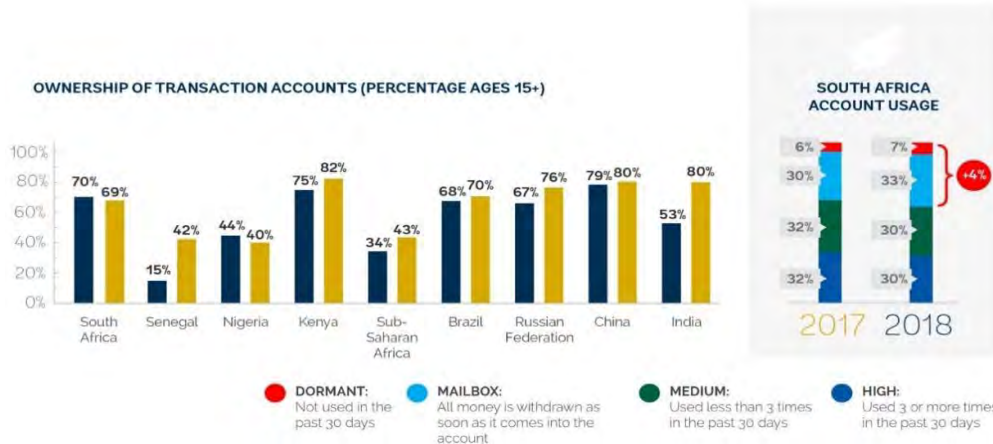
4.2.1. Role of Banks in provision of DFS

South Africa has a large and sophisticated banking sector that is investing significant resources in digitization. As at end of 2017, the banking sector which is dominated by five[70] major banks had assets accounting for 108 percent of GDP. Many banks have digital strategies to modernize their delivery channels and enable use of digital data for decision making purposes. In 2016 major banks in South Africa spend between 10 percent and 18 percent of operating costs on IT expenditure.[71] Disruptive innovation in the traditional deposit-taking space has seen more digital banks enter the market, these include Discovery, Tyme and Bank Zero[72].

In response to changing customer needs, many banks have modernized their delivery channels to facilitate provision of digital banking mechanisms through the internet banking and mobile banking applications. A wide range of electronic payment instruments are offered (payment cards, electronic fund transfers etc.) and the volume of electronic transactions has been on the rise over the past years with electronic fund transfer largely replacing cheques and widely used by employers to pay salaries.

In South Africa, only locally registered banks may issue e-money, since issuing e-money is considered as deposit-taking.[73] Hence, despite a high mobile phone penetration, mobile money market is still in its infancy with only 19 percent of South Africans (ages 15 years +) having a mobile money account. Non-

---

68 FinScope 2018.
69 Global Findex, 2017
70 Standard Bank, FNB, ABSA , Nedbank and Investec
71 COEFS, Impact of Fourth Industrial Revolution on South Africa Financial Services
72However, it should be noted that these banks might still require certain on-boarding requirements to be conducted in person
73 E-Money can be further differentiated into prepaid cards, online money and mobile money.

banks attribute the low percentage to the legal framework that requires non-banks to offer their services jointly with a bank, which reduces profitability and flexibility in their product and service offering. Existing mobile money solutions are not interoperable, resulting in a limited network size and/or customer acceptance. The relatively high share of the population that has a transaction accounts reduces the incentive to open mobile money accounts. However, the high propensity of over-the-counter domestic remittances indicates that there are payment service needs currently unmet by transaction account offerings by banks.

Despite broad range of DFS service and products offered, usage of DF services and products remains low due to factors ranging from high infrastructure cost to low customers awareness and preference for cash. As the World Bank South Africa Retail Banking Diagnostic (2017) highlighted, product design and fees on transaction accounts by major banks do not distinguish between low-income and high-income customers thus making these products costly for low-income customers. In addition, consumers may be reluctant to use internet or mobile banking due to high cost, including the cost of data / airtime to access such electronic services, as highlighted in the financial infrastructure section of the report. Importantly, for at least a portion of the population, and not necessarily because of low income, there is likely to be a strong preference for human interaction, whether due to a lack of understanding, or lack of trust or comfort, with electronic channels.

4.2.2. Role of Fintech and non-banks in DFS

Digital developments have also been observed in other areas of the financial system from lending to capital markets. Fintech has the potential to increase access to financial services through digital channels and by reducing barriers to entry. In line with the Bali Fintech Agenda we have used the term fintech to describe the advances in technology that have the potential to transform the provision of financial services spurring the development of new business models, applications, processes, and products. South Africa's fintech industry is small – with a current estimation of 219 firms[74] - but growing and gaining international recognition. The large majority of fintechs in South Africa provide services already provided by traditional financial services providers such as banks. However, fintechs aim to provide these services faster and cheaper, often servicing low income consumers who have been historically excluded.There are however several barriers to growth and scale such as the funding environment and the shortage of skills as highlighted in the digital entrepreneurship and digital skills sections of the report.

The use of smartphones as mobile point of sale devices is reducing the cost and complexity of payments. As with other regions across the world, mobile payments have been the first area to be disrupted by the new wave of emerging technology. Solutions like Snapscan and Zapper are eliminating the need for point of sale devices altogether. These are being supported by innovative security measures such as location-based identification, biometrics, and card tokenization which protects customers and increases confidence in digital channels.

Bank-fintech collaboration in South Africa has matured as the fintech market developed. This contrasts with the early approach which was to acquire fintech to limit their growth. The market is now seeing much more collaboration in this sector from bank-sponsored fintech accelerators to partnering with startups, which is also leading to the development of more business to business (B2B) solutions such as those for digital ID or cybersecurity. Another interesting feature that has been associated with the development of

---

74 Fintech Landscaping report forthcoming: National Treasury, World Bank, Genesis

fintechs is the growth of banking-as-a-platform where a platform sometimes housed by a bank draws in products and services from an array of innovative third-party providers that exist outside the core banking architecture.

Besides fintech, several banks use third-party agents to facilitate customer acquisition and product usage while several banks use retail stores (e.g. Shoprite, Pep, Pick'n Pay) to facilitate transactions. Services provided by these retailers consist essentially of domestic money transfers, cash back from bank accounts (including social grant payouts), third-party bill payments, and the sale of co-branded access-type accounts. For example, ABSA bank has a relationship with Pep whereby co-branded PEP plus debit cards can be purchased at Pep via an off-the-shelf debit card. The Pep staff at the till undertake the necessary customer due diligence requirements.

Third-party agent models have not been sufficiently leveraged to reach the 'last mile' and improve access for financial consumers in South Africa. While data gaps and limitations do not allow for a robust comparison of agent networks across countries, it appears that South African banks have not fully leveraged the potential of third-party agent models to reduce transaction costs by using existing infrastructure to reach financial consumers.

4.2.3. Policy and Regulatory Environment

In 2018 National Payment System Framework and Strategy Vision 2025 was launched and National Payment System (NPS) policy document was issued. The strategy focuses on a broad range of reforms including promoting competition and innovation, interoperability, flexibility and adaptability and financial inclusion. To achieve this objective the SARB using its statutory payment system oversight and regulatory powers has initiated the review of NPS legislative and regulatory framework and has issued policy paper on required changes to the NPS Act and related regulatory framework.

The Payments Association of South Africa (PASA) a payment system management body with delegated authority from the SARB is the main regulatory body for retail payments in South Africa. PASA's mandate is to authorize retail payments system operators to operate in the South African NPS. PASA is governed by a constitution that defines its functions, structures and activities as a self-regulatory body. Currently PASA has 28 members, all of which are banks with two exceptions: Diners Club and Postbank which are "designated clearing system participants". In addition, PASA has authorized 4 PCH system operators (Visa, MasterCard, BankservAfrica and Strate) and 80 payment system operators.

Importantly, the 'twin peaks' regulatory and supervisory model adopted in 2018 has key implications for NPS supervision. The reform has led to establishment of a new regulator, namely the Financial Sector Conduct Authority (FSCA) that will be responsible for market conduct issues that impact customers in the payment environment.The definition of the scope of the FSCA's involvement in the payment system is yet to be finalized and included in the relevant regulatory provisions. .[75]

Policy and Regulation - Market Entry
The non-banks role in payment space is constrained due to regulatory barriers. The South Africa Banks Act limits the activities of taking deposits and provision of payment services to banks. Article 1 of the Act clearly sets out definitions for a deposit and the business of a bank which clearly delegates payment

---

75 Review of the National Payment System Act 78 of 1998, Policy Paper, September 2018, SARB

intermediation to banks and prohibits 'non-banks' from accepting deposits, unless sponsored by a bank. Under the NPS Act, non-banks can operate as third-party payment providers to process payments that are due to third parties.

Policy and Regulation - Delivery Channel and Innovation

An Intergovernmental Fintech Working Group (IFWG) has been established to provide a mechanism for policy makers and regulators to jointly understand fintech developments and create an enabling Fintech policy. IFWG is comprised of representatives from the National Treasury, the South African Reserve Bank, the Financial Sector Conduct Authority, and the Financial Intelligence Center (FIC). Based on initial consultations with industry and civil society, including fintech firms, the IFWG formed workstreams, including on private crypto assets, peer to peer lending, innovation policy and engagements (including the formation of innovation hubs).

The IFWG is working on Fintech policy and strategy for South Africa to develop a conducive regulatory environment. Moreover, a position paper on crypto assets was developed by SARB in 2014 which highlighted benefits and perceived risks. Based on extensive consultations coordinated by IFWG a consultation paper on crypto assets released for comment in January 2019.

Innovation hubs are being considered to stay apprised of fintech developments while providing an environment for collaboration. Three structures have been proposed as part of the Innovation Hub: an Innovation Accelerator, a Regulatory Guidance Unit, and a Regulatory Sandbox. The Innovation Accelerator as currently modelled will be an internal SARB structure, led by the Fintech Unit, to fast-track new processes or approaches. The Regulatory Guidance Unit is intended to provide non-binding guidance to fintech and financial sector private sector actors navigating the regulatory framework. A Financial Sector Regulatory Sandbox is also proposed to enable live testing of innovations in a controlled environment while dialoguing with the regulator. Both the Regulatory Guidance Unit and Regulatory Sandbox will be jointly owned by the IFWG. The development of these structures is ongoing.

The South African NPS has achieved full interoperability of ATM infrastructure through the SASWITCH service provided by BankServ Africa. However, in their quest to facilitate person to person (P2P) transfers and purchases of goods and services, banks and other non-bank players have developed innovative products that have led to a proliferation of proprietary payment instruments (e.g. mobile money, prepaid cards) and proprietary payment solutions (e.g. domestic remittances, transit payments) which are not interoperable.

The use of Quick Response (QR) code payment schemes is also fast finding its way into the South African market; however, these schemes are also not interoperable. Unless significant interoperability is achieved adoption of this technology by consumers and merchants may fail to achieve scale. Although some efforts are reported to be under way by some providers to address this, an industrywide initiative may be ideal to achieve full interoperability.   An opportunity to establish interoperability at the technical/operational level based on a commercial model which attracts under- and unserved end customers has therefore not been exploited.

Exclusivity arrangements are present in the market and will continue to hamper competition. Western Union and MoneyGram are the dominant players in the money transfer operator space and have included exclusivity clauses in their agent agreements with banks and exchange bureaus. The existence of exclusivity agreements prevents remittance service providers from competing on the price and quality of

services offered and acts as a barrier to entry of new remittance service providers, and stifles opportunities for promoting more efficient use of existing infrastructure.

The cost of compliance with customer due diligence (CDD)/know your customer (KYC) requirements has always been viewed as onerous by the banking industry, yet the cost of non-compliance can have far reaching financial implications. A collaborative initiative by the banking industry to introduce KYC centrally managed services is underway and this is expected to bring efficiency and reduce costs.

South Africa legislation allows for simplified KYC requirements up to certain thresholds; however, a review is needed to ensure these thresholds are not creating barriers to access and usage.[76] "Exemption 17" applies to low-value transactions in general and creates a second tier of compliance that aligns compliance requirements with lower risk. In addition, SARB guidance note also provides exemption for mobile banking and new forms of remote banking. The maximum limit for low-value transactions and debits from such an account is up to R1,000 per day above which full verification is required. For cross-border remittances, the exemption applies to transactions of funds not exceeding R3000 per day and R10 000 in a calendar month. The aim of this exemption is to reduce the costs involved in remitting funds and thereby encouraging remitters to use formal channels for funds transfers.

Policy and Regulation - Managing Risks of Digital Finance

Currently, the consumer protection framework, does not cover non-bank financial service providers, including payment services. The Conduct of Financial Institutions (COFI) Bill which is envisaged to provide comprehensive market conduct requirements under which the FSCA will operate was published for public consultation in December 2018. It is important that the bill provide adequate provisions on market conduct supervision including for payment service providers. In addition, FSCA is currently developing product standards to improve disclosure requirements for various banking products, it would be important to develop such standards for digital financial products.

The protection criteria for e-money customers' funds is provided in the SARB Position Paper on Electronic Money. In line with the requirements of the Bank Act, the Position Paper requires that banks managing e-money products hold these in a separately identifiable e-money account for each holder of e-money and comply with the relevant sections of the Banks Act and its Regulations. In addition, a bank, as the holder of an e-money deposit, must, on demand, redeem the electronic value held on the instrument for central bank currency, at par. Issuers of e-money are also required to ensure that e-money users are made aware of the conditions of use, the liability of the issuer and what recourse the holder of the e-money would have in relation to the issuer.

In 2017, SARB issued guidance note on cyber-resilience encouraging banks to adopt international practices related to cyber-resilience.[77] Based on SARB on-site information technology reviews of banks, key findings suggest that maturity of IT risks at some banks require further improvement. In addition, though banks have adopted internationally recognized best practices and IT risk frameworks, these frameworks still need to be tailored to South African banks' specific needs. Importantly the findings suggest a lack of adequate cybersecurity skills, both locally and internationally. Owing to the increasing

---

76 The exemptions to the general integrity principles for low-value transactions are established under the Financial Intelligence Center Act.

77 The guidance note was issued following the issuance of CPMI and IOSCO guidance on cyber-resilience for financial market infrastructures in June 2016

nature and complexities of cyberattacks, most banks have increased their resources, financially and/or otherwise, to counteract the onslaught of cybersecurity. In addition, industry collaborations and information sharing with other industry players is reiterated as being crucial.[78]

4.2.4. Infrastructure: Retail Payments Infrastructure

South Africa's National Payment System (NPS) is well developed and has benefited from many years of dedicated payment systems reform efforts. The main players in the retail payments landscape comprise: banks and non-bank service providers including payment clearing house system operators, system operators and third-party payment providers.

Non-bank service providers' access to the payment system is not automatic and has to be authorized subject to specific requirements. BankServ Africa, a privately-operated automated clearinghouse (ACH) is the main player responsible for processing retail payments in South Africa. It is responsible for switching and clearing interbank obligations for retail payments such as electronic fund transfers (EFT), cheques, card, internet and automated teller machine (ATM) transaction. Because of its systemic nature, BankServ Africa has been designated by the SARB as a financial market infrastructure (FMI) meaning that it must comply with international standards and best practices for such infrastructures, to which the SARB subscribes.

4.2.5. Infrastructure: Credit Infrastructure

The credit reporting system is fairly developed and has sufficient depth particularly for individuals. There are currently 29 companies registered as credit bureaus under South Africa law, with four of the companies – TransUnion, Experian, XDS, and Compuscan – serving as the major credit bureaus. The four credit bureaus principally report individual credit information and collect both positive and negative credit data systematically from banks, financial institutions, utility companies and retailers.[79] The banks and financial institutions can access borrowers credit information online. The credit bureaus provide credit scores that banks and financial institutions can use to assess credit worthiness. These four bureaus are associate members of the South Africa Credit and Risk Reporting Association (SACRRA), which has established certain rules to improve data quality (e.g. type of data, frequency of updates, definitions, etc.).

Given limited coverage of credit data for businesses and high level of informality in MSME sector, digitization of MSME businesses and use of alternate data could help improve coverage. The estimated total size of South Africa's MSME market, including formal and informal enterprises, is 5.78 million of which only 14 percent is formalized.[80] Thus much of the economic and financial activity of MSMEs is not recorded that can be used for credit assessment. However, these MSMEs as well as unbanked individuals are leaving vast digital footprints and data trails. Every time the individuals and MSMEs use cloud-based services, browse the internet, use their mobile phones, engage in social media, use e-commerce platforms, or manage their receivables, payables, and recordkeeping online, they create digital footprints. Credit providers can leverage on this alternative data including transactional (payments) data, behavioral data and social media data to determine capacity and willingness of a borrower to repay loans.

---

78 SARB Banking Supervision Report 2017

79 However South Africa has large number of registered credit providers at approximately 6,679. Of these only 2,003 are currently submitting their credit data through the transmission hub and many small credit providers are still not providing credit data.

80 The Unseen Sector A report on the MSME Opportunity in South Africa, IFC and World Bank

4.2.6. Leveraging recurrent payments to increase usage of DFS

Digitizing large-volume recurrent payment streams offer an opportunity to promote better use of accounts and other delivery channels while improving transparency and safety. In South Africa social grants, remittances and utility bill payments are among key channels used by lower income segments.

Social Grants

About 26 percent of adults in South Africa receive a social grant compared to Sub-Saharan Africa average of 7 percent.[81] As reported by Global Findex data 2017, 74 percent of social grant recipients received their payment through an account at a financial institution or through a mobile phone. As the World Bank's 2016 report highlights,[82] as with many other similar programs throughout the world, a large share of recipients withdraws the full amount of grant on the same day that the funds are available.[83]

Several factors may contribute to low usage of accounts and require in depth assessment beyond the scope of this report. Potential reasons include concerns earlier concerns raised on unlawful debits from grant beneficiaries accounts, keeping grant in the account may be interpreted as an indication that beneficiary is no longer alive or high balance could be an indication that beneficiary does not need payment immediately. Another reason could be high fees on cash withdrawal and limited functionality available through the South Africa Social Security Agency (SASSA) accounts and cards.

Promoting convenient and affordable use of SASSA account may enable recipients to increase the usage of account and its electronic payment features. This includes the possibility to use the account for payment of utilities, airtime, to send or receive payments or make merchant payments at low or no cost. In addition, the possibility to save in the account if so desired could be encouraged. Further it must be ensured that effective consumer protection service, redress mechanism and financial awareness training in connection to account is available to understand the various features and functionalities of their accounts.

Remittances

About 51 percent of South Africa adults sent or received domestic remittances during the past 12 months of which significant percentage still use over the counter service provider or cash.[84] According to Findex 2017, about 56 percent of adults who sent or received domestic remittance used an account which is comparable to Sub-Saharan Africa average of 51 percent but is much lower compared to 89 percent in Kenya. Of note, though use of mobile phone to send or receive remittance increased to 38 percent in 2017 from 18 percent in 2014, it is much below 95 percent in Kenya. The use of mobile phone provides a convenient and low-cost channel to remit money. A significant percent used over the counter service provider such as retailers (32 percent of senders or recipients) and cash (16 percent of senders or recipients).

The cross-border remittance market holds significant potential but remains largely informal. The international remittance flows of approximately ZAR 25-30 billion are primarily destined to Zimbabwe and

---

81 The Global Findex Database 2017
82 Achieving Effective Financial Inclusion in South Africa: A Payments Perspective, World Bank 2016
83 Based on SASSA report, as reported by South Africa Post Bank, 85 percent of the amount was withdrawn within first week for November-December 2018.
84 The Global Findex Database 2017

Lesotho.[85] Charges are substantial with the average remittance cost along formal channels estimated at 17 percent of the value sent – nearly 10 percent above the global average.[86]

Key aspect limiting further expansion in the use of account to channel remittances including prevalence of close-looped systems. The Mzansi money transfer service between big four banks and Postbank, which was established as interoperable domestic remittance service, failed to succeed in getting significant market share. Cross-border remittance services are generally also closed-loop as remittance service providers in the originating country (South Africa) partner with limited number of disbursing agents in the receiving country.

Utility and other bill payments

About 47 percent of South Africa adults paid utility bills during the past 12 months however 64 percent of payers made the payment using cash only. Only 32 percent used an account to pay the bill compared to 85 percent in Kenya which is quite low considering that many banks offer bill payment options through account. One key factor is lack of reliable and convenient platforms as well as incentives provided by utility companies to enable customers to pay directly to them via their accounts vis-à-vis through intermediaries in cash.

4.3. RECOMMENDATIONS AND NEXT STEPS

Overall South Africa has made significant progress on digital financial services and non-traditional players including fintech are gradually transforming the market. Going forward, it would be important to upgrade the regulatory environment to reduce barriers to entry to retail payment systems and support to development of fintech ecosystem. The interoperability of person to person payment instruments and solutions needs to be improved to promote usage. With the expansion of digital delivery channels by banks and fintech, there is need to improve consumer protection and simplified KYC. The use of alternate data is gaining traction and could help in access to credit for MSMEs, particularly in the informal sector. Below are key recommendations.

Need to reduce barriers on access to retail payment systems. As part of the ongoing review of NPS, Banks Act and relevant legislation the SARB and National Treasury needs to amend the legislation to (i) enable access to the NPS to all licensed/authorized entities either through a direct membership or through indirect membership and (ii) recognizing payments as an activity distinct from deposit taking. In addition, review of current policy on limiting the issuance of e-money products to only banks is need with the aim to foster and channel both bank and non-bank payment initiatives. Following review an Emoney directive needs to be issued. The governance and membership of PASA needs to be reviewed including to allow fair access to non-banks.

Need to support the development of the fintech ecosystem with specific emphasis on financial inclusion. The IFWG need to issue periodic clarifications or guidelines on regulatory interpretations specifically regarding the treatment of innovative activities, e.g. cloud computing or use of AI for financial services. The policy framework needs to provide possibility of a regulatory "sandbox or hub" to provide a testing environment to support the development of fintech that specifically supports financial inclusion.

---

85 Technoserve (2017), Domestic Remittances in South Africa
86 World Bank (2017), Remittance Prices Worldwide

Promoting open, interoperable and interconnected systems and products to expand usage. Given the proliferation of proprietary payment instruments and payment solutions which are not interoperable, SARB needs to develop and issue regulation mandating interoperability and adoption of open standards to enable existing closed-loop systems to become open-loop systems or to be able to become interoperable with the open loop systems. There is scope to enhance the open looped systems to enable licensed entities to offer transaction accounts to their customers to enhance financial inclusion. Also, effective regulatory coordination on technology adoption such as promoting the use of a national USSD code for seamless interoperability would be useful.

Improving consumer trust in digital financial services. With the establishment of market conduct authority, there is need to develop product standards covering digital financial products and introduce simple complaint handling procedures and redress mechanism for users of digital financial services that are currently lacking. In addition, review of KYC thresholds for basic transaction accounts, cross border remittances and mobile banking is needed to ensure these thresholds are not create barriers to uptake.

Alternative sources of credit and means of assessing credit are gaining traction. To encourage these developments, it would be important to implement pilots as envisioned by the National Credit Regulator to test the use of alternate data to improve credit risk assessment particularly of informal businesses and unbanked individuals and develop framework based on pilot to expand credit information on individuals and MSMEs. Digitization of MSMEs would also facilitate credit expansion particularly to informal businesses.

Leveraging large volume recurrent retail payments could expand usage particularly within the low-income consumer segment. Promoting convenient and affordable use of SASSA account (such as for payment of utilities, airtime, to send or receive payments or make merchant payments) at low or no cost could help increase the usage of accounts and its electronic payment features. There is a need to introduce interoperability in domestic remittance services and introduce incentives to use transaction account and/or mobile money account for sending/receiving remittances.

4. DIGITAL ENTREPRENEURSHIP

4.1. BACKGROUND AND IMPORTANCE OF DIGITAL ENTREPRENEURSHIP

Vibrant digital entrepreneurship is a key pillar of a strong digital economy, in turn a source of new products and services, business models, and markets. Digital entrepreneurship, seen to encompass the launch of new digital ventures either offering new products or leveraging existing technologies and business models[8788], also including digital private sector platforms[89], has the potential to contribute to overall competitiveness and job creation. A strong entrepreneurship ecosystem[90] that influences the creation and success of such digital ventures is instrumental in translating innovations into businesses, ultimately supporting wealth creation and higher standards of living for a country[91].

South Africa's underlying digital entrepreneurship dynamics are quite positive. South Africa is already a key player in Africa for digital entrepreneurship, serving as a "hub" for many initiatives and investments, and as an essential entry point for major global digital players, including, among others, Google, Airbnb, Amazon Web Services, and IBM Research Lab. A strengthening tech ecosystem has enabled the emergence of digital startups and platforms across technology segments. A round of recent successful tech startups have raised over USD 100M[92], and there is an expanding number of medium-sized South African technology companies, a growing share of which are also black-owned. In addition to creating jobs, digital entrepreneurs have helped drive social impact in areas such as health (e.g. HearX), transport and logistics (ParcelNinja), and education (GetSmarter). Successful digital entrepreneurs also reinvest in the ecosystem through funds such as Team Africa Ventures.

However, due to key weaknesses in specific policy, available financing and support, digital entrepreneurship is not reaching full potential, and South Africa's leadership is being increasingly challenged on the continent. The lack of some key ingredients and pressing gaps in regulation are holding South African digital entrepreneurs back. These include insufficient availability of digital skills, elevated infrastructure costs and limited reach, limited access to early stage finance, some specific legislation detrimental to business operations, insufficient coordination of entrepreneurship support initiatives, both public and private, including spatially, and limited diversity and inclusivity of the sector as a whole. At the same time, other ecosystems on the continent are developing strongly. Botswana recently ranked number 1 in Sub Saharan Africa in the global entrepreneurship index[93], while Kenya and Nigeria also have strong ecosystems, as attested by the recent string of high profile exits of digital startups; relative African

---

87 The term 'Digital Entrepreneurship' most commonly refers to the process of creating a new—or novel—Internet enabled/delivered business, product or service. This chapter focuses on startups that bring new digital product or services to market. Welsum, v. D., World Bank Group, "Enabling Digital Entrepreneurs" 2016.

88 These are typically defined as young (under 5 years) firms that are pursuing growth

89 Digital Private Platforms can be defined as "multi-sided marketplaces with business models that enable producers and users to create value together by interacting with each other and by facilitating matching, searching, exchanging, transactions, and so on". (World Bank Group, Information and Communications for Development 2018: Data Driven Development, accessible at https://openknowledge.worldbank.org/handle/10986/30437)

90 The background paper's methodology and analytical process rely on the DE4A diagnostic toolkit, which is based on the Babson Entrepreneurship Ecosystem model. This model captures the most widely held understanding of entrepreneurial ecosystems, including the factors that constitute them and how they work, namely: policy, finance, support organizations, culture, human capital, and markets

91 Global Innovation Index ranking, World Intellectual Property Organization (WIPO), 2018

92 These include: Thawte, Fundamo, Nimbula and GetSmarter (Timm, S. 2017. "Are these the 10 all-time biggest exit deals for SA startups?" VentureBurn https://ventureburn.com/2017/06/biggest-sa-exit-deals-digital-all-stars/) with a few recent large exits e.g. LobsterInk being undisclosed.

93 Global Entrepreneurship and Development Institute, 2018. "Global Entrepreneurship Index 2018"

newcomers such as Ghana, Tunisia, and Tanzania, have been continuously improving in Global Entrepreneurship Index (GEI) rankings in recent years.

4.2. Diagnostics Findings: Current State of Digital Entrepreneurship

4.2.1. Policy Framework and Business Environment for Digital Entrepreneurs

Both national and provincial governments are playing a strong role in the development of digital entrepreneurship in South Africa; but current policies fail to reflect changing global operating conditions in the industry, while policy action suffers from lack of coordination and insufficient monitoring. Although South Africa's Doing Business could be improved overall (82nd out of 190)[94], overall support for entrepreneurship is quite pro-active, through a number of specific agencies (e.g. Technology Innovation Agency) and programmes (e.g. Technology & Human Resource in Industry Programme, Support Programme for Industrial Innovation, SA SME Fund), at both the national and provincial levels - with the Western Cape and Gauteng provinces being the most dynamic. The SA SME Fund[95], launched by the President in March 2019 as a partnership between the national government and corporate South Africa for example, foresees that R1,4 billion will be invested into SMEs and startups through pre-selected fund managers with an established track record to kick start economic growth. However, those initiatives often suffer from insufficient adequacy to the specific needs of the sector, especially in the early phases of business development; implementation, coordination and fragmentation remains a significant issue, leading to confusion for entrepreneurs and support organizations; and policies lack robust monitoring and evaluation frameworks, leading to a likely sub-optimum allocation of resources. The national government's e-Government strategy (examined in chapter 3) although going in the right direction, has not yet significantly reduced the administrative burden on digital startups.

Furthermore, some of the existing policies turn out to be either difficult to implement in practice and would need to be adapted, or have an adverse effect on the operations of digitally enabled startups. The following paragraphs will examine in turn: (i) R&D tax incentives; (ii) IP legislation and requirements; (iii) exchange controls; (iv) VAT & Corporate tax issues; (v) ICT and related sector policies; and (vi) labor legislation.

The R&D tax incentive scheme has a cost recovery model that does not benefit SMEs or startups which do not pay taxes until they are profitable, resulting in none of the initial development costs being tax exempt in practice. The SA government provides tax relief for companies engaging in R&D, allowing them to claim up to 150% of qualifying costs against their income tax and accelerated depreciation. This incentive was designed to encourage private-sector investment in scientific and technological research and development activities and to help the country achieve a target for R&D expenditure of 1% of GDP, but is not designed for high value and research intensive technology startups, which typically do not break even in their first years of operations; it could thus be usefully adapted. The recently released DST

---

94 http://www.doingbusiness.org/content/dam/doingBusiness/country/s/south-africa/ZAF.pdf. President Ramaphosa has indicated he wants SA in the top 50 countries in 3 years time in his second State of the Nation Address (https://www.gov.za/speeches/president-cyril-ramaphosa-2019-state-nation-address-7-feb-2019-0000)
95South African SME Fund, 2019. https://sasmefund.co.za/

White Paper on Science Technology and Innovation (STI)[96] does call for better incentives related to R&D expenditure for SMEs and startups, which is a positive development.

The Intellectual Property from Publicly Funded Research Act (IPR Act)[97] provides protection to inventors and universities, but additional regulatory approval and non-exclusive IP assignment into spin-outs has resulted in little private sector investment into university developed innovation or government funded startups[98]. The IPR Act applies to any IP (including know-how but excluding copyright in copyrighted works) created with public funds through government grants or in a university, or in a science council environment. The IPR Act ensures that the inventor or creator of the IP and the institution have rights to the IP, but also requires the National IP Management Office (NIPMO) to approve any transaction; thus, exclusive or complete assignment of the IP to an entity is difficult. As spin-outs do not own the IP outright or because of lengthy approval processes by NIMPO, investor risks regarding IP are increased (as well as costs related to deal structuring and legal fees). Owing to scarce successful commercialization of university-based IP, the private sector is hesitant to fund commercialization or market expansion of any company or IP subject to the Act. The DST White Paper on Science Technology and Innovation (STI)[14] also calls for a review of the IPR Act, which is likely to be welcomed in the industry.

As exchange control approval is required to move, license or assign IP offshore, digital entrepreneurs tend to directly register their companies offshore as soon as they start their businesses. Any startup or digitally enabled businesses who wants to trade, operate or raise funding internationally needs reserve bank approval and is subject to the Exchange Control (ExCon) Act[99], which impacts the way in which it manages and exploits its IP. This is significant as IP provides the legal framework through which companies and research institutions can create, protect and commercialize their research, innovations, software and technologies. The Act restricts South African residents from (among other things) selling, assigning or licensing intellectual property (IP) to foreign residents, and paying royalties to foreign residents, without prior approval from the SARB. As a result, digital entrepreneurs who are building scalable, international companies, need to compete globally, and enter into global partnerships, register all IP and the main company offshore as soon as they start their business. As a result, tax payable on income or exit does not accrue to the country. Amendments to the ExCon Act state that an authorised dealer can approve arms length transactions or the creation of an offshore company to raise foreign funds for operations (subject to conditions) for unlisted SA "technology, media, telecommunications, exploration and other R&D companies". These amendments represent an improvement but implementation costs rest with authorised dealers within banks.

Digital startups are unable to claim the Value Added Tax (VAT) they pay when starting their businesses, and corporate tax rates are not necessarily adapted to startups. As VAT registration is only required for companies with a turnover of R1 million per annum, many SMEs are unable to claim this early on, thus the operating costs on which VAT is paid to vendors are often covered by funding which has been secured in exchange for equity. The corporate tax rate for companies ranges from 0% (below R79 000 income p.a.) to 28% (from R550 000 income p.a. upwards) regardless of size. Smaller businesses (less

---

96 Department of Science and Technology, 2018. "Draft Paper on Science Technology and Innovation (STI), 2018
97Department of Science and Technology, 2008. "Intellectual Property Rights from Publicly Financed Research and Development Act (51/2008)" University of KwaZulu Natal website.
98 Technology Innovation Agency, 2018. "Technology Innovation Agency Annual Report 2017" Technology Innovation Agency website.
99South Africa Reserve Bank, 2019. "Currency and Exchange Manual for Authorised Dealers, 2019-04-18"

than R1 million per annum) do have the option of paying turnover tax of between 1 - 3% which can be much simpler. For high growth digital startups however, there is little tax relief for them when they are formed or when they are generating profits, at which point they will be taxed in the same bracket as corporates.

Labour related policies and regulations makes digital startups reluctant to hire full-time employees. The Labour Relations Act is applicable to all companies operating in SA regardless of size, and startups are reluctant to take on the administrative (taxes etc.) and financial burden of hiring staff too soon. As a result many staff at startups are part-time, on short term contracts or consult to the business so that they are not seen as formal employees. Thus, startups that have the potential to create further jobs may be hesitant or take longer to do so.

4.2.2. Support Organizations

A large number of support programs and organizations has enabled the development of clusters of innovations in specific sectors through dedicated accelerators and sector specific financing. South Africa counts 300+ active support organizations for entrepreneurs according to the latest available estimates. These notably include service providers such as innovation districts, incubators, accelerator programs, innovation hubs, and co-working spaces, as well as event organizers and foundations. Whereas only 10%-15% of them are thought to target digital entrepreneurs specifically, sector-specific dynamic clusters are developing, some attracting substantial foreign and domestic investment with growing entrepreneurial success, such as Yoco in fintech, HearX in health, GetSmarter in edtech, and Aerobotics in agritech[100].

The impact of organizations' support on digital business creation, growth and sustainability is however limited by insufficient tailoring. First, support is concentrated on the very early- to early-stage spaces of business development, with limited funding available and less robust support for later stages; it is also concentrated in the affluent urban areas of Gauteng and the Western Cape, leaving large swathes of potential digital entrepreneurs isolated. Second, the quality of services provided by many support organizations is considered quite low overall, including due to the lack of relevant mentors and of meaningful monitoring and evaluation processes. And third, growth stage digital acceleration programs could be better tailored both to the South African context (longer lead times before reaching the fundraising stage) and to facilitate access to markets beyond South Africa.

The long-term financial sustainability and funding of support organizations and programs may become an issue. Most of them are highly dependent on the otherwise successful Enterprise and Supplier Development program (ESD), which has unlocked ZAR 12 billion (USD 900 million) in capital through compulsory contributions from large companies.

4.2.3. Financial Capital

Digital ventures in South Africa face financing gaps throughout most of their lifecycle. The availability of finance for digital entrepreneurs in South Africa is generally low (Figure 15), in the context of difficult access to credit for SMEs overall, with a Getting Credit ranking of 73/190, significantly lower than Kenya (8) and Nigeria (12).

---

100 Detailed case studies of some of these digital startups are included in the Digital entrepreneurship background paper

Figure 15: Summary of the South African financial capital landscape for digital entrepreneurship at various stages
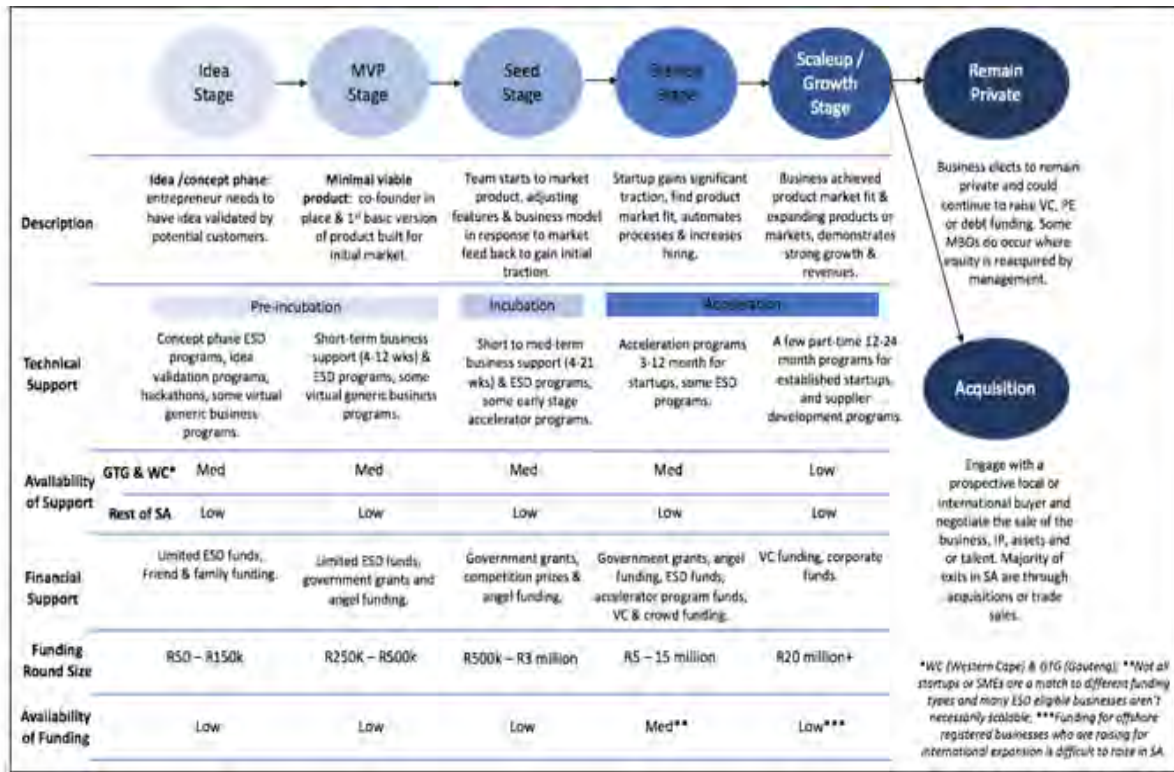
Source: authors

The South African government has various financing and incentive programs for early stage entrepreneurs, but most of these are not suitable for digital entrepreneurs. More than 50 national programs targeting SMEs have been identified, with an estimated 2018 financial year budget of about R18 Bn (of which 48 percent debt finance and 35 percent grants). Most of these programs target very early stage businesses, and only 4 percent target technology SMEs. Minimum trading requirements, cost-sharing clauses or collateral requirements are among criteria not adapted to digital startups, and there is little data on blended finance, most used in many parts of the world.

Angel investors would be most suited to help fill the early stage funding gap for digital startups; there has been more robust growth of later-stage funding through Venture Capital funds, driven by one key piece of legislation, but most of this funding is not going to digital entrepreneurs, and there are strong constraints to further expansion that need to be removed. Angel investors typically contribute more than just financial capital to a startup: by being actively involved, mentoring the founding team, providing strategic or expert advice and introductions to customers etc. Despite the high risk involved, there are few incentives to attract them. Angel investor networks could also be supported to increase effectiveness for funding digital startups. VC financing on the other hand has seen significant growth in both number and value in recent years, reaching 159 deals and R1,16bn in 2017. Amendment of Section 12J of the Income Tax act is responsible for the fast increase in new Venture Capital Companies (VCCs), which has resulted in 165[101] new VCCs being registered with over R3.4 billion committed by February 2018, with

---

101South African Revenue Services, 2019. List of Approved Venture Capital Companies

informal estimates that this will reach R5 billion in 2019[102]. Recent announcements of several large VC funds targeting both South African and African startups are expected to further close the finance gap at the later stage. However, access might remain an issue for black owned companies with weaker networks and expertise, VCCs are restricted to invest into a South African-registered entity (excluding offshore IP and entities) and cannot invest in Fintech by design, and their small size and limited staff capacity are key constraints for further growth. This stresses the need to increase the participation of institutional investors in local VC funds, as currently the funds are relying on a limited number of high net-worth individuals.

	South Africa	Kenya	Nigeria	Senegal	Mexico
Venture Capital availability [1 = extremely difficult; 7 = extremely easy], WEF Global Competitiveness Report, Executive Opinion Survey, 2017	2.87	3.03	1.80	2.57	3.05
Access to credit (ranking from 1 (highest) to 190), Doing Business 2019	73	8	12	144	90

4.2.4. Markets

South Africa is a growing digital market, notably due to the steady digitization of industries and highly sophisticated financial services. The digital market in South Africa is expanding, providing market opportunities for existing and new digital businesses. From 2016 to 2018, smartphone penetration grew almost twofold to 81.7%, and fixed broadband subscriptions around fourfold to 7.5 million. Transactions are conducted more and more digitally. These developments have helped the creation of new business models and services locally, while major global digital platform actors such as Uber and AirBnb have used South Africa as an entry point. The steady digitization of industries and the high level of sophistication in banking and financial services have also been encouraging the growth of Business-to-Business (B2B) digital products and services. Lastly, policy efforts to support opportunities for digital entrepreneurs, especially from previously disadvantaged communities (e.g. through B-BBEE and ESD), and to adopt digital technologies (e-governance), are further market levers.

E-commerce and digital private platforms are an expanding segment of the digital entrepreneurship landscape, but limited information exists as of yet analyzing their role and impact. It is estimated that private platforms currently have close to 1.3M workers in South Africa[103] and revenue in the e-commerce market is estimated at around US$3bn in 2019, with annual growth rates projected of around 10% per annum. with the usage of digital channels for transactions growing accordingly[104]. South Africa rates better in UNCTAD's E-commerce Index compared to Kenya, Nigeria and Senegal (Table 2). This has attracted investments into new business models and services including digital platforms such as SweepSouth, Takealot, and Parcel Ninja (see case studies in digital entrepreneurship background paper). Also, some of the largest global digital platforms are using South Africa as an entry point to the continent, including Uber which launched operations in 2013, Netflix in 2016, Spotify in 2018, and Airbnb. Challenges faced by digital private platforms mirror those already outlined for digital entrepreneurs, with an

---

102 van Zyl, K. 2018 "SARS Section 12J Venture Capital Companies — Hype Versus Substance"
103 insight2impact Africa's digital platforms database (May 10, 2019)
104 For example, according to Global Findex, between 2014 and 2017, the % adults who used the Internet to pay bills or to buy something online in the past year grew from 7.62% to 14.13%. https://globalfindex.worldbank.org/

emphasis in areas such as data privacy and cybersecurity. E-commerce is dampened by restrictions on trading history and costs (3-4% of a transaction) for processing online payments, persistent logistics costs and issues, and some import restrictions.

Overall, market growth and access could still be significantly improved by improving data access and shortening payment cycles. The high cost of broadband data remains a challenge for most South Africans, penalizing key potential growth segments in the digital sector. Long procurement and payment cycles with business buyers also disadvantage smaller, younger, or less well funded players. Government efforts to develop e-services for businesses have only translated into timid actions and results so far, although South Africa is still a leader on the continent, and small businesses find it very challenging currently to win government contracts. Finally, ICT services exports data still show limited global reach while the local market remains limited compared to richer countries outside the continent, despite some successes, also due to infrastructure and persistent inequalities.

	South Africa	Kenya	Nigeria	Senegal	Mexico
ICT service exports (% of exports BOP), 2017, WITS data	16.9	13.19	5.21	36.73	0.29

4.2.5. Entrepreneurship Culture and Talent

The perception of entrepreneurial culture in South Africa is on the rise and quite positive overall, helped by a recent increase in high profile business exits by local digital entrepreneurs, but remains suboptimal due to insufficient collaboration and diversity. Strong startup communities host an abundance of networking events, talks and workshops, which help inspire, and train new entrepreneurs. There is growing participation of previously disadvantaged individuals, and more businesses target disadvantaged communities, with positive social impact. However, the digital entrepreneurship sector remains overwhelmingly white, male, and middle class, even though public and private initiatives such as B-BBEE and dedicated women-led angel investment networks are starting to bridge some gaps. Collaboration between organizations across the ecosystem remains limited, for example between the largest hubs in Western Cape and Gauteng, in spite of strong complementarities.

Limited supply of digital talent remains a key weakness of the South African digital entrepreneurship ecosystem. The paucity of talent is a significant and acute problem at all skill levels, not helped by South Africa's full bottom rank (139/139) in terms of quality of Math and Science education according to the World Bank. Rapid skills programs with promising results have emerged but have faced funding and accreditation issues. The competition for higher-end talent is especially fierce in the corporate sector at large, further exacerbated by current South African visa requirements on the one hand, and foreign initiatives to drain talent such as the French Tech visa – which makes talent needed for (global) growth unaffordable for most digital entrepreneurs – on the other hand.

	South Africa	Kenya	Nigeria	Senegal	Mexico
Percent of firms with female participation in ownership (Enterprise Survey, latest available)	22.6	48.7	16.2	22.9	25.7

4.3. RECOMMENDATIONS AND NEXT STEPS

Clarifying the Regulatory and Policy Frameworks for Digital Entrepreneurship

Identifying and prioritizing a set of digital entrepreneurship policies with clear department leadership would facilitate the growth of digital entrepreneurship. Building on the national 4iR initiative, reviewing existing instruments and policies (through for example a public expenditure review, which could investigate the impact of different existing policy instruments) and developing a comprehensive and consistent set of policies such as done by the Irish government or others[105] would help develop the sector. Strengthening M&E mechanisms of existing policies would better inform both the public and private sectors on the impact and utility of different instruments and accelerate the scaling-up of successful initiatives.

Reforming certain aspects of the business environment to make it more digital entrepreneur friendly would also unlock sectoral growth and job creation. Amending exchange control requirements and processes relating to IP as well as foreign investment into, and sale of, domestic companies would help keep growing digital companies anchored in South Africa. Enabling digital startups to defer R&D tax breaks against taxable income up to 3 years, such as done in Australia, would allow them to fully benefit from further engaging in innovative research. Easing labor legislation for employees in young digital companies could drive employment growth further in the sector. Lastly, reforming regulations to allow IP to be fully assigned to spin out companies could increase private sector investment into university-developed innovation or government funded startups.

Further Strengthening the Digital Entrepreneurship Ecosystem

Increasing the quality and quantity of available digital skills through both long-term investment and shorter-term actions is crucial to continued growth. The paucity of digital skills is a key and acute constraint to the growth of digital entrepreneurship, and more broadly the digital economy. In the short run, scaling out existing successful programs such as the Digital Skills Academy or mLabs Southern Africa and other PPPs, could go part of the way to bridging the gap in general and digital skills. Furthermore, facilitating the coming into the country of foreign highly skilled digital entrepreneurs or professionals through "tech visas" such as done in France, could also positively impact the sector by bolstering the creation of new companies and the mentoring of South African entrepreneurs.

Quality of support provided to entrepreneurs could also be improved, including for better inclusion, scale, and access to foreign markets boosted. Results-based funding is an effective way to improve services quality, especially at the critical ideation and seed stages. Strengthening linkages between Gauteng and Western Cape ecosystems and continuing to address the rural/urban divide can improve learning,

---

105 Startup acts are a new policy tool that some countries, including India, Argentina, Tunisia and Italy, have introduced, with around ten countries currently exploring Acts or legislative tools for startups.

inclusion, and scale, and help build out regional and pan-African programs for later stage digital entrepreneurs to increase access to international markets and mentors.

Expanding Access to Funding

Increasing incentives for angel investors and supporting the structuring of angel networks is critical to drive investment into early-stage digital businesses. In line with what was implemented for VC funds through section 12J, incentives ought to be increased to encourage early stage investments in digital entrepreneurs. Angel investors typically provide additional support in terms of mentorship, experience, and networks, beyond the capital invested. Effective schemes implemented elsewhere such as the UK Enterprise Investment Scheme (EIS) and Seed Enterprise Investment Scheme (SEIS) could usefully be replicated or adapted. Also, supporting the setup and structuring of angel networks has proven instrumental in raising the number and enhancing the quality of angel investors.

De-risking investment could be usefully part of financing schemes for early-stage digital entrepreneurs. De-risking mechanisms targeted to digital entrepreneurs, including through blended finance by governments and intergovernmental agencies on the model of the CORFO program in Chile, which has a successful blended finance mechanism, could encourage an increase in the availability of early stage funds for digital entrepreneurs.

Continuing Active Support to Diversity in Digital Entrepreneurship

Active support to diversity in the digital entrepreneurship sector should be continued. Significant strides have been made in encouraging previously disadvantaged communities to break into and succeed in digital entrepreneurship, notably through the B-BBEE legislation, which has given both a financial incentive and access to markets for these communities. The number of women in the sector, and in digital entrepreneurship more specifically, remains however low. Notwithstanding a number of skills training and upgrading programs, it would be useful to further incentivize support organizations to increase tailored support provided to women and black-led digital businesses. Examples of programs could include DigitalUndivided and Project Diane, in the US, for diversity, and She Starts, Australia and We In Social Tech, in the UK, for women.

5. DIGITAL SKILLS

6.1. BACKGROUND AND IMPORTANCE OF DIGITAL SKILLS

Foundational for a digital economy to flourish, developing a digitally competent workforce and digitally literate citizens who can reap the benefits that the digital society brings will greatly help South Africa's digital economy development.

In the absence of an African framework for digital skills development, this chapter draws from existing frameworks to conceptualize digital skills. The Digital Skills Pyramid used by the World Bank broadly groups digital skills into three layers: Digital user skills; Digital specialist skills; and e-Business skills. Digital user skills include those necessary for users of digital platforms, software, or devices. For everyone to participate in a digital economy, it is essential that all citizens have the opportunity to develop digital literacy skills that allow them to live, work, learn, and participate in a modern society. Digital specialist skills are those needed to produce digital software and hardware, design and maintain systems, and conduct research. E-business skills are those associated with digital entrepreneurship, creating innovative business models, and marketing of digital products and services. Another example is the European Union, which suggested a more comprehensive framework, the DigComp 2.0[106]. This framework identifies five areas of competences with 21 specific competences: information and data literacy, communication and collaboration, digital content creation, safety and problem solving. More recently, UNESCO added two more competences to the DigComp 2.0 framework, to include competences related to devices and software operations, and career related competencies.

South Africa recognizes the potentially significant impact a digital economy could have on its economic growth and its citizens' development. Moreover, the country recognizes the foundational role that digital skills play in building such an economy.

South Africa has a well-developed policy landscape that guides skills development: The Skills Development Act of 1998 set in motion development of various policy documents from different government departments in response to the urgent need to rectify past injustices of racial exclusion, as well as catering to the needs of a newly formed and growing democracy. Unfortunately, until very recently, these departments seldom collaborated, and policy documents were developed in isolation.

There is recognition of the importance of digital skills from the highest governing levels: the President officially recognized the importance of digital skills in 2002. For the next two decades, several policies, strategies, plans and interventions on national and provincial levels were developed and implemented to address infrastructure, resources, and to create opportunities for youth. These efforts were laudable, but largely uncoordinated. Recent international calls for countries to prepare for the 4iR gave rise to renewed recognition of the importance of technology and digital skills for a growing economy in South Africa. This has led to the establishment of the Presidential Commission on the 4iR, as well as other commitments, such as the radical technological transformation of the schooling system within the next six years. The Commission should tie together the work that has been done by different departments and lead a collective and more coordinated effort towards digital skills development.

---

106 EU DigComp 2.0: The Digital Competence Framework for Citizens. https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

Research informs policy and practice in digital skills development. Different large-scale research projects related to digital skills development or the broader 4iR developments are taking place. The DTPS is conducting environmental scans to determine the extent of digital skills development needs among the general population, organizations, and government. This also implies monitoring and evaluation to track development over time, as well as a sense of accountability flowing from that knowledge. The DHET conducts biennial research to identify the occupations in highest demand to guide institutions to adapt to changing needs. The 2018 list included 25 ICT-related occupations in high demand. Finally, the DST is leading research related to 4iR developments.

South Africa has extensive unused human capital on which it can draw. The country ranks 126th out of 157 countries on the Human Capital Index, which is far below what would be expected from its per capita income level. To some extent, this can be attributed to the poor quality of schooling and persistent resource and race-based inequalities in education. Combined with a 'Not in Education, Employment, or Training' (NEET) rate of over 30%, low labor market participation (55%), youth representing almost two thirds of the unemployed, and an underqualified workforce (20% with tertiary qualification, 32% with secondary education and almost half of the workforce not having a grade 12 certificate), there is much unused potential to develop.

There are some good examples of collaboration taking place: Public-private collaborations, particularly between provincial governments and universities (as public entities) and private institutions are increasing. In addition, several initiatives, ranging from programs to empower youth with ICT skills, to embedding digital skills in all forms of education and everyday life, are taking place under leadership of provincial governments or private companies.

There is a variety of qualifications on offer: various public and private providers are offering a range of different courses and using different models of learning (e.g. online tutoring, face-to-face sessions, peer learning, mentoring, boot camps, etc.). These courses also vary in duration, cost, and whether the outcome of the course results in an accredited qualification, certification, or possible placement in partner companies.

South Africans are slowly getting connected: many South Africans are engaging with social media, and predominantly through mobile technology, while the drive to get all citizens (and schools in particular) connected to the internet is progressing well.

6.2. DIAGNOSTIC FINDINGS: CURRENT STATE OF DIGITAL SKILLS

Inadequate and Insufficient Supply of Digital Skills: South Africa ranks 116th out of 140 countries in the Global Competitiveness Report's assessment of digital skills among the population (3.5 out of 7)[107]. Contributing factors might include limited access to digital devices or the internet, low production of ICT graduates from the formal post-school sector, and the slow pace of adoption of formal ICT curricula with rapid developments in the field. Because they do not have key skills available from potential employees, companies miss out on innovation opportunities[108]. In the private sector, many shorter courses or coding

---

107 WEF. 2018. The Global Competitiveness Report.
108 PWC annual CEO survey. 2019.

boot camps focus on producing large numbers of qualifications, yet candidates only receive three or four months of coding training, which might not be enough. Adequate practical experience is important.

6.2.1.   Digital Literacy

Specific digital skills need to be identified within the levels of digital skills. DTPS has made considerable progress in conceptualizing digital skills, establishing the iKamva National e-Skills Institute (iNeSI), and initiating environmental scans to determine the need for digital skills among the broader public, in organizations, and within government. The DTPS is also in the process of developing a digital skills strategy that will inform a national approach to developing such skills.

Digital skills development in schools still has a long way to go. There are still major gaps in access to devices and connectivity in schools, as well as concerns about teacher training in effective technology use. To date, around 34% of schools have a computer laboratory and almost 70% have some form of access to internet. While the Department of Basic Education (DBE) uses several partners to provide teachers resources and technical skills to use technology in teaching, the training is sporadic and not universally standardized. Such training is also criticized by educational technologists because it mainly focuses on technological skills training and does not teach teachers to embed technology into teaching practices to enhance learning. Moreover, there seems to be a lack of a collective understanding of what digital skills entail and whether they should be introduced as stand-alone curricula in school or embedded throughout the broader curriculum.

The quality of basic education remains a key constraint for the South African education and training system and labor market.[109] Central to these quality concerns are learners' low literacy levels and underperformance in mathematics. Moreover, there do not seem to be clear pathways between school-level and post-school education in ICT-related subjects. Very few learners also have access to ICT electives from Grade 10 because of lack of infrastructure, resources, or teachers. Limiting opportunities for learners to engage with technology provides a partial explanation of underuse of the human capital potential that the country has, particularly among the less advantaged youth. It also contributes to criticisms from the private sector that learners are not developing the skills they need to enter into the workplace or to pursue further studies. For example, the quality of Mathematics education is ranked 128th out of 137 countries in the WEF Global Competitiveness Ranking[110]. Further, of the 800,843 learners who wrote the National Senior Certificate examination in 2018, 172,043 (21%) obtained a bachelor's pass and only 58% passed Mathematics with a score higher than 30%.

6.2.2.   Professional Digital Skills

The production of post-school graduates does not meet labor market demands. The low number and quality of graduates produced by both TVET Colleges and higher education institutions does not meet the demand of the sector. For example, close to 3,000 vacancies exist in the top 10 most-difficult-to-fill ICT positions[111]. In contrast, fewer than 7,000 students graduated in 2016 with general ICT-related degrees.

In addition, students enrolling for ICT-related degrees in higher education are not graduating. Of the students enrolled in 2014 for undergraduate diplomas/certificates and three-year bachelor's degrees in

---

109 Labour Market Intelligence Project. 2016. Skills supply and demand in South Africa.
110 http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_EOSQ130.pdf
111 MICTseta: https://www.mict.org.za/downloads/MICTSETA_SSP_2018_to_2023_Draft.pdf

ICT, only 14%, and 13% respectively completed their qualifications in 2016[112]. In general, the percentage of students who enroll for three-year ICT degrees and graduate after six years in the system is 41%.[113]

Curricula are not responding fast enough to meet rapid changes in demand. TVET Colleges and universities are criticized for having outdated curricula, and not being responsive enough to fast-changing skills demands.

A lack of coherent, national leadership and collaboration leads to lack of coherence in institutional offerings. On a national level, the slow pace of responding to digital skills needs is a concern. For example, since the first official focus on developing digital skills in 2002, several policies, strategies, plans, and initiatives have been developed and implemented. However, due to lack of coherent coordination between departments and the variety of other important skills that need to be developed as a matter of urgency, collective recognition of the importance of digital skills is only resurfacing now. Further, the lack of coherent focus on how the digital economy is developing has resulted in only pockets of innovation in partnerships or degree offerings. For example, eleven universities in the country are offering programs and modules in 4iR and related fields of artificial intelligence and robotics[114]. However, no real collective efforts to link qualification offerings with emerging and changing job demands have surfaced.

6.2.3. e-Business Skills

Only some universities are recognizing the link between entrepreneurship, business, and ICT skills. Some have made ICT degrees more flexible to include business subjects as electives, while others have included ICT subjects as electives into commerce faculties. However, these changes are not systemic and only selected institutions are responding to the need to develop entrepreneurial and business skills with ICT skills.

6.3. RECOMMENDATIONS AND NEXT STEPS

Coordinate the conceptualization and implementation of the different levels of digital skills. A coordinated effort between the different governmental departments including DTPS, DHET, National Skills Authority (NSA), DBE, and provinces is needed to build on the work that has been done, and to identify which specific skills in each of the three levels need to be developed. Policy guidance that clarify conceptual needs will lay the foundation for practical interventions. Realistic policies are also needed to guide the technological transformations envisioned for the country, to guide how digital skills should be implemented at scale to reach all citizens and empower those who are unemployed or undereducated. These policies should emphasize quality, accountability, and monitoring and evaluation.

Make use of educational platforms, such as Technical and Vocational Education and Training (TVET) colleges and Community Colleges, to develop digital literacy in unemployed youth. Many learners do not complete schooling, do not have funds for further education, and end up unemployed or in low-paying, informal employment. Digital literacy development should not be limited to schools; it could also be made

---

112 CRA: https://cra-sa.com/publications/south-africa-survey/south-africa-survey-2019
113 Council on Higher Education. 2018. Vital Stats 2016.
114 https://www.skillsportal.co.za/content/careers-high-demand-needed-thrive-4ir

available to the broader public through partnerships with TVET and Community Colleges, as well as private sector initiatives to make sure everyone is included in digital skills development.

Define clear developmental pathways between schooling and post-school education and training. While all South Africans should be educated to be digitally literate, there should be clear pathways aligning basic skills development with more sophisticated professional pathways. The identification of skills needed for emerging interdisciplinary job demands should underpin the options learners have.

Explore innovative ways of including digital skills in the wider curriculum and to scale up private-sector led initiatives. The process of developing, aligning, testing, training, and implementing new formal curricula (in schools and post-school institutions) is too lengthy to be responsive to the fast-changing demand. Innovative ways of training through partnerships (public/private, inter-sectoral, intra-sectoral, regional, and so on) should be considered as part of meeting this need. South Africa has no shortage of private-sector initiated models for rapid digital skills development, which may be scaled up through PPPs.

Equity of access to resources should be foregrounded. The persistent inequalities of the education system will not be rectified if only urban and well-resourced schools have access to good teaching, smart classrooms, computers, internet, and a wider selection of subjects from which to choose. Additional opportunities through external partnerships should be made available to learners, teachers, schools and institutions from rural or disadvantaged areas.

Emphasize formalized teacher training in general, as well as use of technology to enhance learning. This goes beyond showing teachers how technology works. Partnerships with educational technology consultants and closer collaboration with teacher training centers and universities to align formal teacher education with the technological revolution envisioned in schools is very important.

Implement post-school curriculum reform pertaining to qualifications related to professional digital skills. Innovative ways of speeding up the responsiveness of formal qualifications to the needs of the labor market should be explored and developed. Examples of partnerships between public and private sectors show great potential to help in this regard.

DHET, DTPS and SETAs could play a larger role in identifying cross-sectoral professional digital skills and providing guidance to develop interdisciplinary skills. The DHET and NSA could also provide more guidance to post-school institutions to align their curricula (the skills and knowledge being developed) with labor market needs beyond the jobs-in-demand list. For example, incorporating the range of cognitive and socio-emotional skills that are emerging as in demand for the field. Such efforts will widen the reach of professional digital skills in other disciplines. Innovations using technology to enhance advancements in disciplines such as agriculture, health, or manufacturing all need professional digital skills. Having professional digital skills combined with disciplinary knowledge enables translation between technology and contextual needs. Innovative ways of creating opportunities for students in these disciplines to engage in professional digital skills could make significant contributions to the digital development of disciplines.

Increase the number and the quality of IT graduates: The poor throughput of students enrolled for ICT degrees should be investigated to identify where the problem lies. For example, it could be that the articulation gap is too wide for students to adjust to university curricula, students might not find the

content relevant for the work they want to pursue, or they might even find faster alternatives to reach the same level of competence and drop out.

Formalize the entrepreneurial link between ICT and business studies within and beyond higher education. The trend of merging ICT subjects with business degrees or vice versa could be broadened and incorporated into qualifications offered by TVET Colleges and the MICT SETA. Curricula could also be reviewed to optimize the relevance of complementary subjects to enhance entrepreneurship, for example, including digital entrepreneurship in the development of innovative business models, or including the marketing of digital products and services in marketing degrees.

Innovative ways of including e-business skills in curricula or short courses are needed. A flourishing digital economy needs more than users, developers, and maintenance of technology. It requires entrepreneurship and innovation to expand the delivery of products and services. Therefore, innovative ways to enhance entrepreneurship and innovation need to be in place, some of which might include: flexible curriculum structures in ICT or business degrees; reviewing the relevance of curriculum content; tying startup funding to hybrid degree completion; and investing in public-private partnerships through which students could gain business experience or engage in short courses to develop business (or ICT) skills.

Globally, the digital economy has become an important driver of economic growth, innovation, and improved service delivery. This is also true for South Africa. Digitalization is revolutionizing how people bank, travel, access health care services, access public services, and do business. The number of internet users worldwide tripled from 1 billion in 2005 to 3.2 billion in 2015. The contribution of the digital economy is expected to grow from 15.5 percent to a quarter of global GDP between 2016 and 2026. Every dollar invested in ICT infrastructure between 2016 and 2018 is estimated could yield USD 5 by 2025. ICT is outperforming several sectors in South Africa, and already contributes around 17 percent of service exports and close to 3 percent of GDP (currently more than the contribution of agriculture)[115]. Internet penetration in South Africa is the highest in Sub-Saharan Africa at 54 percent, smartphone penetration is high at 81 percent, and the country remains ahead of regional peers in the Global Competitiveness Index, notwithstanding growing competition from the likes of Tunisia, Kenya, Egypt, Nigeria, and Mauritius; emerging markets such as Brazil, Mexico, Turkey, and India are still ahead.[116]

The diagnostic findings show much promise for improved continental leadership on the digital economy agenda but highlight the need to speed up implementation on many fronts for all South Africans to benefit. This is in particular the case in digital infrastructure and skills, where there is an urgency to push forward key reforms and stimulate private investments to address key challenges. Fast tracking implementation of digital public platforms will be important for improving service delivery and driving up demand for digital services, including the development of a next-generation digital identity system to help provide trust to underpin online transactions in South Africa's growing digital economy. Regarding digital entrepreneurship and financial services, South Africa needs to play to its strengths, working on incentives and regulations for improved growth.

Starting with infrastructure, South Africa should further enable private investment by working to improve the policy and regulatory environment. Competition in the broadband market needs to be enhanced, while alleviating concerns around mobile spectrum capacity and improving network performance. Promoting rural connectivity and more affordable data prices should continue to be priorities, alongside stimulating growth in high-speed fixed-line adoption. To address fragmentation and improve coordination, South Africa should urgently consider updating its national broadband policy with realistic targets and implementation models based on international best practices. The country should ensure the independence and capacity of the regulator, fast-track 4G licensing, enforce stricter rules on infrastructure sharing, and reconsider its universal access fund model. This would return South Africa to a path towards universal internet access, in turn leading to investment in other segments of the digital economy.

Reforms to develop digital public platforms should be stepped up. The implementation of national and provincial digital government strategies needs to be adequately resourced, for instance through private participation. To reduce fragmentation and proliferation, government should also improve the coordination and communication among Departments, SOEs and agencies driving this agenda, clarifying the role of each player at the national level. Leveraging the asset of a very strong foundational ID system South Africa could build a next generation digital ID system that allows South Africa to participate in the global digital economy (Europe's eIDAS for example). Finally, the government needs to take a holistic view of interoperability challenges, by defining a set of interdisciplinary measures required for further data sharing and openness, and appointing a central entity that will take stock, monitor and evaluate the development of digital government services.

115 Statistics South Africa (2017) Statistical Release P04414 Available online
http://www.statssa.gov.za/publications/P0441/P04414thQuarter2018.pdf
116 World Economic Forum (2018) Global Competitiveness Report

Key recommendations regarding digital financial services center around increasing the usage of these platforms. South Africa should lower the barriers on access to retail payment systems and support the development of the fintech sector. Other key recommendations to consider on the supply-side include promoting regulation mandating open, interoperable and interconnected systems and products, so as to enhance efficiency and expand usage. These efforts would leverage on some of recent demand-side interventions such as the establishment of the market conduct authority, expected to improve consumer trust in digital financial services. Policy makers should also encourage alternative sources of, and means of assessing, credit, particularly for informal businesses. Leveraging the large volume of recurrent payments could expand usage of accounts, particularly within the low-income consumer segment.

A number of reforms are also needed to realize the potential of South Africa's promising digital entrepreneurship ecosystem. The government should strengthen the business environment for digital entrepreneurs through policies and regulations addressing constraints such as exchange controls, unclear Intellectual Property assignment, ill-targeted R&D tax breaks, limitations affecting digital payments for e-commerce businesses, and insufficient labor flexibility for young digital firms. In addition to strengthening e-business skills, the government could also consider introducing a tech visa allowing for the easy sourcing of skills. Finally, to scale up and reach global markets, South African digital entrepreneurs need expanded funding; this could be provided through de-risking mechanisms, as well as the setting up of supporting networks and incentives for angel investors.

Weaknesses in terms of skills need to be addressed to unlock investment into other segments. As it stands, South Africa is already experiencing an exodus of ICT skills. While tackling weaknesses stemming from the low quality of education is a long-term agenda, a number of reforms such as better coordination of the conceptualization and implementation of the different levels of digital skills, greater utilization of educational platforms, such as Technical and Vocational Education and Training (TVET) colleges and Community Colleges, the clarification of developmental pathways between schooling and post-school education, and the design of training informed by industry demands, could yield significant short-term outcomes. The fast-changing nature of the ICT sectors argues for setting up private participation in rolling out relevant digital resources in schools and reforming curricula so as to keep it relevant to industry needs. Such reforms to curricula should include formal e-business studies to prepare South Africa's digital entrepreneurs.

Overall, in order to unleash further benefits from the digital economy, South Africa would benefit from a holistic approach to address the constraints affecting the DE4A pillars, including strong public sector engagement that could enable further private participation. The new Presidential Commission for the 4th Industrial Revolution could become an important coordination forum in this respect. Efforts to establish common policy orientations and improve internal coordination between government departments and key agencies, as well as the monitoring and evaluation of existing policies would be beneficial. The private sector has a key role to play in South Africa's digital economy, highlighting the importance of improved dialogue between the government and private operators on prevailing digital challenges. With current fiscal challenges in particular, the government should increasingly adopt an enabling role, leveraging private sector expertise and facilitating increased private sector participation in delivering on public policy objectives under all foundational pillars of the digital economy.

Element	Key recommendations include
Digital infrastructure *Fast, high-quality and affordable broadband internet is a key foundation of the digital economy.*	● Update the national broadband policy with realistic targets and implementation models based on international best practice. Instead of continuing to rely on SOEs as implementation vehicles for SA Connect, the Government could use its anchor role on the market more proactively, by aggregating its demand for connectivity and have this delivered through bulk procurements. ● Ensuring ICASA's independence and capacity under the new merged national department is key. The regulator needs clear mandate confirming its field of play, to help alleviate concerns around its independence and expedite stalled actions such as 4G licensing. ● Prioritize fast-tracking spectrum assignment for 4G use to increase network capacity and alleviate constraint that the operators currently face and to take a proactive stance towards 5G licensing. The government could implement spectrum caps or spectrum set aside as part of the auction process to encourage market entry by operators with lower access to capital or set more demanding coverage requirements for existing MNOs ● If the Government proceeds with the WOAN and introduces it again as part of the ECA Amendment Bill, there needs to be careful consideration of the model to avoid monopolistic outcomes in the wholesale market, maximize private investment and ensure continued incentives to innovate. ● Make efforts to encourage further positive developments in the fixed-line broadband market. Promotion of infrastructure sharing, pro-competition open access principles, implementation of transparent wholesale pricing and determination of regulatory remedies could help the market grow.
Digital platforms *Platforms enable public and private sector organizations to devise new or better outcomes for citizens.*	● Improve coordination and communication among Departments and Agencies driving this agenda at the national level. important for the center of government to clarify the specific role of each key entity involved in the digital government at the national level, drawing from international best practices. ● Adequately resource the implementation of the national and provincial digital government strategies. Review the available resources at both the national and provincial level. If a budget shortfall is indeed identified, then fostering public-private partnerships could be one of the possible solutions. ● Taking a holistic view of interoperability challenges to remove some of the existing bottlenecks. Review the legal and regulatory review to ensure that the Departments and Agencies are legally allowed to share data, push mainstream APIs to ensure that the databases of various Departments and Agencies can communicate with each other on a selective as-needed basis, and implement a change management strategy to target behavioral constraints for further data sharing and openness. ● Improve digital capacity within public sector by rethinking the offerings of government training institutions such as the National School of Government (also under DPSA). ● Monitoring and evaluate the development of digital services to improve their efficiency, cost-effectiveness, and citizen-centricity. This will avoid duplication and will aid in further improvement and efficiency of e-services. Eventually, it will also help to make digital service delivery more citizen-centric.
Digital financial services	● Reduce barriers on access to retail payment systems. Amend the legislation to (i) enable access to the NPS to all licensed/authorized entities either through a direct or indirect membership

Individuals and households need convenient and affordable channels by which to pay, save, and borrow.	and (ii) recognizing payments as an activity distinct from deposit taking. Review the current policy on limiting the issuance of e-money products to only bank. ● Promote open, interoperable and interconnected systems and products to expand usage. SARB needs to develop and issue regulation mandating interoperability and adoption of open standards to enable existing closed-loop systems to become open-loop systems or to be able to become interoperable with the open loop systems. ● Improve consumer trust in digital financial services by using the market conduct authority to develop product standards covering digital financial products and introduce simple complaint handling procedures and redress mechanism for users of digital financial services that are currently lacking. In addition, review of KYC thresholds. ● Leverage the large volume recurrent retail payments to expand usage particularly within the low-income consumer segment by promoting convenient and affordable use of SASSA account at low or no cost could help increase the usage of accounts and its electronic payment features.
Digital entrepreneurship *A pool of supported, skilled entrepreneurs leads to new products, services, business models, markets, and jobs.*	● Identify and prioritize a set of digital entrepreneurship policies with clear department leadership. Building on the national 4iR initiative, review existing instruments and policies, and develop a comprehensive and consistent set of policies (grouped under a policy statement such as done by the Irish government or others) would help develop the sector. ● Reform certain aspects of the business environment to make it more digital entrepreneur friendly. Amend exchange control requirements and processes relating to IP as well as foreign investment into domestic companies, enable digital startups to defer R&D tax breaks against taxable income, ease labor legislation in young digital companies and reform regulations to allow IP to be fully assigned to spin out companies. ● Improve the quality of support provided to entrepreneurs, including for better inclusion, scale, and access to foreign markets boosted. Use results-based funding, strengthen linkages between Gauteng and Western Cape ecosystems and continue to address the rural/urban divide to improve learning, inclusion, and scale, and help build out regional programs for later stage digital entrepreneurs to better access international markets and mentors. ● Increase incentives for angel investors and supporting the structuring of angel networks is critical to drive investment into early-stage digital businesses, drawing on section 12J and international best practice. ● De-risk investment targeted to digital early-stage entrepreneurs, including through blended finance by governments and intergovernmental agencies on the model of the CORFO program in Chile. ● Continue active support to foster more diversity in the digital entrepreneurship sector, including through incentivizing support organizations to increase tailored support provided to women and black-led digital businesses drawing on international best practices.
Digital skills *The development of a vibrant, dynamic, and inclusive digital economy requires a deep labor pool.*	● Coordinate the conceptualization and implementation of the different levels of digital skills to build on the work that has been done, and to identify which specific skills in each of the three levels need to be developed. ● Develop digital literacy in unemployed youth by making use of educational platforms such as Technical and Vocational Education and Training (TVET) colleges and Community Colleges. ● Define clear developmental pathways between schooling and post-school education and training. The identification of skills needed for emerging interdisciplinary job demands should underpin the options learners have.

	● Explore innovative ways of including digital skills in the wider curriculum and to scale up private-sector led initiatives. Leverage and scale-up private-sector initiated models for rapid digital skills development through PPPs. ● Foreground equity of access to resources. Additional opportunities through external partnerships should be made available to learners, teachers, schools and institutions from rural or disadvantaged areas. ● Emphasize formalized teacher training in general, as well as use of technology to enhance learning, including through partnerships with educational technology consultants and closer collaboration with teacher training centers and universities. ● Implement post-school curriculum reform pertaining to qualifications related to professional digital skills. Examples of partnerships between public and private sectors show great potential to help in this regard. ● DHET, DTPS and SETAs could play a larger role in identifying cross-sectoral professional digital skills and providing guidance to develop interdisciplinary skills. ● Increase the number and the quality of IT graduates by investigating where the problem lies in the poor throughput of students enrolled for ICT degrees. ● Formalize the entrepreneurial link between ICT and business studies within and beyond higher education, including by broadening the trend of merging ICT subjects with business degrees or vice versa. .

Accenture. 2018. "Creating South Africa's Future Workforce".
https://www.accenture.com/t20180201T173907Z__w__/za-en/_acnmedia/PDF-70/Accenture-Creating-South-Africa-Future-Workforce.pdfla=en

Accenture. 2019. Digital Transformation Initiative | Accenture. [online] Available at:
https://www.accenture.com/us-en/company-event-wef-2017-digital-transformation-initiative

Bizcommunity. 2019. President appoints commission on fourth industrial revolution.
https://www.bizcommunity.com/Article/196/831/189620.html

Business Media Mags. 2018. "Is Fibre Lighting Up the Townships".
http://businessmediamags.co.za/business/made-in-sa/is-fibre-lighting-up-the-townships/

Businesstech. 2019. Amazon Web Services to open new data centers in South Africa.
https://businesstech.co.za/news/cloud-hosting/279877/amazon-web-services-to-open-new-data-centres-in-south-africa/

Centre for Risk Analysis. 2018. ''This is the digital version of the Survey for 2019''. https://cra-sa.com/publications/south-africa-survey/south-africa-survey-2019

Competition Commission of South Africa. 2019. ''Data Services Market Enquiry. Provisional Findings and Recommendations''.

Competition Commission of South Africa. 2019b. "Data Services Market Enquiry. Final Report".

Council on Higher Education. 2018. ''Vital Stats 2016: Monitoring & Evaluation'',
https://www.che.ac.za/media_and_publications/monitoring-and-evaluation/vitalstats-public-higher-education-2016

Council for Scientific and Industrial Research. 2018. Spectrum requirements for Wholesale Open Access Network (WOAN). Released as part of the DTPS Invitation to Provide Written Comments on the Proposed Policy Directions to the Authority on Licencing of Unassigned High Demand Spectrum 27 September 2018.

Deloitte (nd) "Industry 4.0: Is Africa ready for the digital transformation?"

Dutta, S., Lanvin, B. and Wunsch-Vincent, S. 2018. The Global Innovation Index 2018: Energizing the World with Innovation. World Intellectual Property Organization,
https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018.pdf

EU Science Hub - European Commission. 2019. The Digital Competence Framework 2.0 - EU Science Hub - European Commission. https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

FinScope. 2018.'' How South Africans are leveraging informal and formal financial markets''.
http://finmark.org.za/wp-content/uploads/2019/01/FMT_Fsc_Leavebehind_CB4.pdf

Global Entrepreneurship and Development Institute. 2018. "Global Entrepreneurship Index 2018"

Government Publications. 2015. National Cybersecurity Policy Framework for South Africa | Government Publications. http://www.governmentpublications.lib.uct.ac.za/news/national-cybersecurity-policy-framework-south-africa

Gov.za. 2019. President Cyril Ramaphosa appoints Commission on Fourth Industrial Revolution | South African Government. https://www.gov.za/speeches/president-cyril-ramaphosa-appoints-commission-fourth-industrial-revolution-9-apr-2019-0000

Hjort J. and Poulsen J. 2018. ''The Arrival of Fast Internet and Employment in Africa''. NBER Working Paper No. 23582

ICASA. 2018. ''Bi-Annual Report on the Analysis of Tariff Notifications Submitted to ICASA for the Period 1 July 2017 to 31 December 2017''.

ICASA. 2019a. "State of the ICT Sector Report.''

ICASA. 2019b. "Information Memorandum for International Mobile Telecommunications Spectrum Assignment"

IFC. 2018. "The Unseen Sector A report on the MSME Opportunity in South Africa''.

Insight2impact. (2019). Africa's digital database platform.

ITU. 2018. The economic contribution of broadband, digitalization and ICT regulation. https://www.itu.int/pub/D-PREF-EF.BDR-2018

Katz R.L. 2013. The impact of South Africa Connect on jobs and the economy. Presentation in the Broadband Workshop (DoC) 11-12 November

Labour Market Intelligence Partnership. (2016). Skills supply and demand in South Africa. http://www.lmip.org.za/

MICTSETA. 2016. "Skills Sector Plan 2018 to 2023''. https://www.mict.org.za/downloads/MICTSETA_SSP_2018_to_2023_Draft.pdf

National Cybersecurity Policy Framework. 2015.

PWC. 2018. Industry 4.0 | PwC's Strategy&. https://www.strategyand.pwc.com/industry4-0

PWC. 2019. Annual Global CEO Survey https://www.pwc.com/gx/en/ceo-survey/2019/report/pwc-22nd-annual-global-ceo-survey.pdf

Research ICT Africa 2018 The State of ICT in South Africa, Policy Paper No.5, Series 5, Accessed online https://researchictafrica.net/wp/wp-content/uploads/2018/10/after-access-south-africa-state-of-ict-2017-south-africa-report_04.pdf

Research ICT Africa. 2019. Research ICT Africa Mobile Pricing (RAMP). https://researchictafrica.net/ramp_indices_portal/

Research.ukzn.ac.za. 2008. http://research.ukzn.ac.za/Files/IPR_from_PFR_D_Act_No_51_of_2008_1.sflb.pdf

Sanderson, C. 2019. NAPAfrica IXP ranks in top 15 globally • Teraco Data Environments. [online] Teraco Data Environments. https://www.teraco.co.za/news/napafrica-ixp-ranks-top-15-globally/

Sanren. 2019. SANReN – South African National Research Network. https://www.sanren.ac.za/

SARB. 2017. ''Banking Supervision Report''.

SARB. 2018. ''Review of the National Payment System Act 78 of 1998'', Policy Paper, September 2018

SAVCA. 2018. "SAVCA Venture Capital Industry Survey: Covering the 2017 calendar year"

SARB. 2019. [online] Available at: https://www.resbank.co.za/RegulationAndSupervision/FinancialSurveillanceAndExchangeControl/Documents/Currency%20and%20Exchanges%20Manual%20for%20Authorised%20Dealers.pdf

SARS. 2019. Venture Capital Companies. https://www.sars.gov.za/ClientSegments/Businesses/Pages/Venture-Capital-Companies.aspx

Sasme. 2019. Home Page - Sasme. https://sasmefund.co.za/

Skills Portal. 2019. "Careers in high demand needed to thrive in 4iR''. https://www.skillsportal.co.za/content/careers-high-demand-needed-thrive-4ir

South Africa Connect. 2013. "Creating Opportunities, Ensuring Inclusion: South Africa's Broadband Policy. 2013.''

Speedtest.net. 2019. Analyzing India's 4G Availability: Including a Look at the 15 Largest Cities. https://www.speedtest.net/insights/blog/india-4g-availability-2019/

Statistics South Africa. 2017. "Gross Domestic Product: Fourth Quarter 2018'', Statistical Release P04414 http://www.statssa.gov.za/publications/P0441/P04414thQuarter2018.pdf

TechCentral. (2019). Huawei Cloud now available in South Africa – TechCentral. https://techcentral.co.za/huawei-cloud-now-available-in-south-africa/87985/

Technoserve. 2017. ''Domestic Remittances in South Africa''.

Telegeography. 2019. Telecommunications market research that's data-driven. https://www.telegeography.com/

Towerxchange.com. 2018. TowerXchange - telecom tower industry the independent community for the telecom tower industry - TowerXchange – telecom tower industry. https://www.towerxchange.com/

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

Van Zyl, K. 2018. "SARS Section 12J Venture Capital Companies — Hype Versus Substance."

World Bank. 2016a. ''Achieving Effective Financial Inclusion in South Africa: A Payments Perspective''.

World Bank. 2016b. "Development Report 2016: Digital Dividends", Washington, DC:

World Bank. 2016c. "Enabling Digital Entrepreneurs".

World Bank. 2017a. ''Remittance Prices Worldwide''.

World Bank. 2017b. "Global Findex Survey 2017: Measuring Financial Inclusion and the Fintech Revolution'', Washington DC

World Bank. 2018a. "Republic of South Africa Systematic Country Diagnostic. An incomplete transition: Overcoming the legacy of exclusion in South Africa", Washington, DC: World Bank.

World Bank. 2018b. ''Doing Business South Africa'', Washington DC

World Bank. 2018c. "Innovative Business Models for Expanding Fiber Optic Networks and Closing the Access Gaps''.

World Bank. 2019a. "South Africa Economic Update #12: Tertiary Enrolment Must Rise", Washington, DC: World Bank.

World Bank. 2019b. ''Unlocking Innovation in South African Public Service''.

World Bank. 2019c. "South Africa Country Private Sector Diagnostic. Creating Markets in South Africa: Boosting Private Investment to Unlock South Africa's Growth Potential", Washington, DC: World Bank.

World Bank. 2019d. "South Africa ID Case Study: Identification for Development (ID4D)", Washington, DC: World Bank.

World Economic Forum. 2018. ''The Global Competitiveness Report''.

World Economic Forum. 2019. http://reports.weforum.org/pdf/gci-2017-2018-scorecard/WEF_GCI_2017_2018_Scorecard_EOSQ130.pdf

IMPLEMENTATION PROGRAMME GUIDE

FOR THE NATIONAL DIGITAL AND FUTURE SKILLS STRATEGY OF SOUTH AFRICA

2021 - 2025

This implementation programme was prepared for the Department of Communications and Digital Technologies (DCDT), by Luci Abrahams and Mark Burke, LINK Centre, University of the Witwatersrand, Johannesburg.

Acknowledgement for funding and knowledge contributions:
International Telecommunication Union (ITU)
International Labour Organisation (ILO)
United Nations Development Programme (UNDP)

Visualisations were applied by:
The Data Innovator
Please cite references for all storyboard visualisations as Abrahams, Burke & The Data Innovator, 2021.

Table of Contents

Figures

Tables

Acronyms

APIs	Application Programming Interfaces
BBI	Broadband Infraco
BPS	Basic Package of Support
CAT	Computer Applications Technology
CDW	Community Development Workers
CfE	Care for Education
CHE	Council for Higher Education
CHW	Community Health Workers
CIDA	Community Individual Development Association
COGTA	Department of Cooperative Governance and Traditional Affairs
CPSI	Centre for Public Service Innovation
CWD	Children with Disabilities
CWP	Community Works Programme
DBE	Department of Basic Education
DCDT	Department of Communications and Digital Technologies
DDF	Digital Development Fund
DEL	Department of Employment and Labour
DHA	Department of Home Affairs
DHET	Department of Higher Education and Training
DHP	Digital Hubs Programme
DISA	Disability info South Africa
DoH	Department of Health
DPSA	Department of Public Service and Administration
DRLR	Department of Rural Development and Land Reform
DSAC	Department of Sports, Arts and Culture
DSBD	Department of Small Business Development
DSC	Digital Skills Centre
DSD	Department of Social Development (DSD)
DSF	Digital Skills Forum
DSI	Department of Science and Innovation
DTIC	Department of Trade, Industry and Competition
DWYPD	Department of Women, Youth and Persons with Disabilities
ECD	Early Childhood Development
EIG	Education Infrastructure Grant
EMIS	Education Management Information System
EPWP	Expanded Public Works Programme
ETDP-SETA	Education and Training Sector Education and Training Authority
GCIS	Government Communication and Information Services
GDP	Gross Domestic Product
GITOC	Government Information Technology Officers Council
GTAC	Government Technical Advisory Centre
HEIs	Higher Education Institutions
HEMIS	Higher Education Management Information System
HWSETA	Health and Welfare Sector Education and Training Authority
ICASA	Independent Communications Authority of South Africa
IEG	Infrastructure and Efficiency Grant

IRSA	Information Regulator South Africa
IT	Information Technology
LAP	Labour Activation Programme
LGSETA	Local Government Sector Education and Training Authority
LIASA	Library and Information Association of South Africa
LMIP	Labour Market Intelligence Programme
LURITS	Learner Unit Record Information and Tracking System
MICT-SETA	Media, Information and Communication Technologies Sector Education and Training Authority
MLO	Mzansi Libraries On-Line Project
MOOCs	Massive Open Online Courses
NARYSEC	National Rural Youth Service Corps
NATED	National Accredited Technical Education Diploma
NCC	National Consumer Commission
NCPD	National Council of and for Persons with Disabilities
NCV	National Certificate Vocational
NECT	National Education Collaboration Trust
NEET	Not-in-Employment-Education-or-Training
NEMISA	National Electronic Media Institute of South Africa
NLF	New Leaders Foundation
NLSA	National Library South Africa
NOLS	National Open Learning System
NPMN	National Pathway Management Network
NRF	National Research Foundation
NSA	National Skills Authority
NSF	National Skills Fund
NSG	National School of Government
NT	National Treasury
NQF	National Qualifications Framework
NYDA	National Youth Development Agency
NYS	National Youth Service
PC4IR	Presidential Commission on the Fourth Industrial Revolution
PDFDL	Professional Development Framework for Digital Learning
PSET	Post-School Education and Training
PSETA	Public Service Sector Education and Training Authority
PWD	Persons with Disabilities
PYEI	Presidential Youth Employment Intervention
QCTO	Quality Council for Trades and Occupations
SACE	South African Council for Educators
SALDRU	Southern Africa Labour and Development Research Unit
SALGA	South African Local Government Association
SA-SAMS	South African School Administration and Management System
SAQA	South African Qualifications Authority
SASSA	South African Social Security Agency
SAYC	South African Youth Council
SEDA	Small Enterprise Development Agency
SITA	State Information Technology Agency

STEAMIE	Science, Technology, Engineering, Arts, Mathematics, Innovation and Entrepreneurship
SWOT	Strengths, Weakness, Opportunities and Threats
TVET	Technical and Vocational Education and Training
TUT	Tshwane University of Technology
UIF	Unemployment Insurance Fund
UNISA	University of South Africa
USAF	Universal Access and Service Fund
USAO	Universal Service and Access Obligations
YES	Youth Employment Service

Mini-Glossary

Case management
(search for case management images)

The practice and processes of managing the needs and requirements of people on a case-by-case basis. Case management usually includes screening, assessing needs, creating a plan, supporting, communicating, following-up and evaluating the success of the engagement with the person.

Digital badging
(search for digital badges images)

Evidence or a testimonial confirming that the holder has a specific skills set, where the skills can be acquired offline or online, and where the evidence or testimonial can be accessed online

Digital skills ecosystem

The full set of factors, actors and institutions that makes the acquisition of digital skills possible and within which digital skills is usable

Distributed ledger technologies
(search for distributed ledger technologies images)

Technological infrastructure and applications that enable shared access, validation and data updating across multiple sites, persons, institutions, and even countries, through an immutable ledger that maximises data security.

Eduplaytion

A convergence of education and play enhanced by digital applications, in particular using digital games in education

Implementation measure

The specific implementation actions required to make the particular strategy effective

Micro-credentialing

A credential for a skill acquired through writing specific tests, or compiling a portfolio of evidence demonstrating that a particular skill has been mastered, typically shorter than a more formal qualification, available as a digital certificate on completion (related to digital badging)

Platform of platforms

A digital platform that integrates other lower level data platforms and provides a high level of data integration on a particular theme eg digital skills matching

1. Introduction: Purpose of Digital and Future Skills Building

This implementation programme guide is the overarching document for the implementation of the National and Future Digital Skills Strategy of South Africa, adopted by the Cabinet of the Republic of South Africa in August 2020. The implementation programme sets out the measures, lead institutions and stakeholders, as well as the required inputs and major activities, and the expected outputs, outcomes and impact. For effective implementation, this document should be read together with the strategy itself, the background research paper on digital skills gaps, and the research framework for digital skills, available as a package of documents from the Department of Communications and Digital Technologies (DCDT). The guide should be seen as the foundation for the continuously evolving efforts to create a strong digital skills building ecosystem.

A special focus for the implementation programme guide is on digital skills for decent jobs for youth, noting that young people between the ages of 18 and 35 are the generation that will empower the South African economy and society with digital skills, noting too that more than 8 million young people are not-in-employment-education-or-training (NEET). This special focus is related to the South African government's engagement with the global campaign for decent jobs, in concert with local stakeholders and global partners. Equally important is the focus on gender balance, and the focus on persons with disabilities, as gender and disability balance must be prioritised, must receive as much attention and funding as possible, in order to ensure skills equity in 21st century South Africa.

Digital and future skills are a vital component of South Africa's human resource capacity growth path, without which it cannot renew its economic sectors, government and social sectors. Economic competitiveness needs digital and future skills, digital government needs digital and future skills, South Africans need digital and future skills, relevant to the particular objectives of each. The implementation ideas have been thoroughly canvassed in five consultative workshops, with engagement with the DCDT, the Department of Basic Education (DBE), the Department of Higher Education and Training (DHET), the Department of Public Service and Administration (DPSA), with many other national and provincial departments, with participants from local government, with participants from youth-based organisations, from the persons with disabilities community, and with participants from GITOC. Participants in these workshops contributed their insights and experience to the design of this implementation programme for digital and future skills. Noting that consultative engagements will continue and be deepened in the course of implementation, the consensus in the workshops is that building digital skills requires urgency, creativity, and making the many breakthroughs that will foster an agile rather than a bureaucratic approach to fostering skills in this dynamic field.

2. Context for the Implementation Programme

Research confirms that ***digital skills must be complemented by 21st century skills*** in order to effectively address the many levels of the digital divide. In its Professional Development Framework for Digital Learning, the Department of Basic Education, in particular, recognises the importance of complementary skills, such as creativity and problem-solving ability. This perspective on complementary digital and 21st century skills needs to become an open consensus between government and the broad range of digital

8

skills stakeholders, so that South Africa collectively engages in digital and future skills development, based on a common understanding.

The *socio-economic context* within which the development occurs presents significant challenges, noting the slow GDP growth and recessionary conditions experienced in 2020. The labour market is experiencing stronger demand for future skills each year, with skills markets specifically focused on digital and other 21st century skills. The implementation programme is informed by a brief *SWOT analysis* that recognises that are many, serious constraints to achievability. Some insights from the SWOT analysis are embedded in the sections below.

The implementation programme takes a *digital skills ecosystem perspective to creating South Africa's digital innovator capability*, meaning that implementation must take place within a context where (i) access to infrastructure is advancing, (ii) skills development is focused on building actual digital solutions in industry, commerce, government and society, (iii) skilled digital bilinguals create applications (apps) for economy and society and (iv) leadership of the digital skills strategy is powerful, collaborative and effective (Figure 1).

Figure 1: Overarching perspective on digital skills
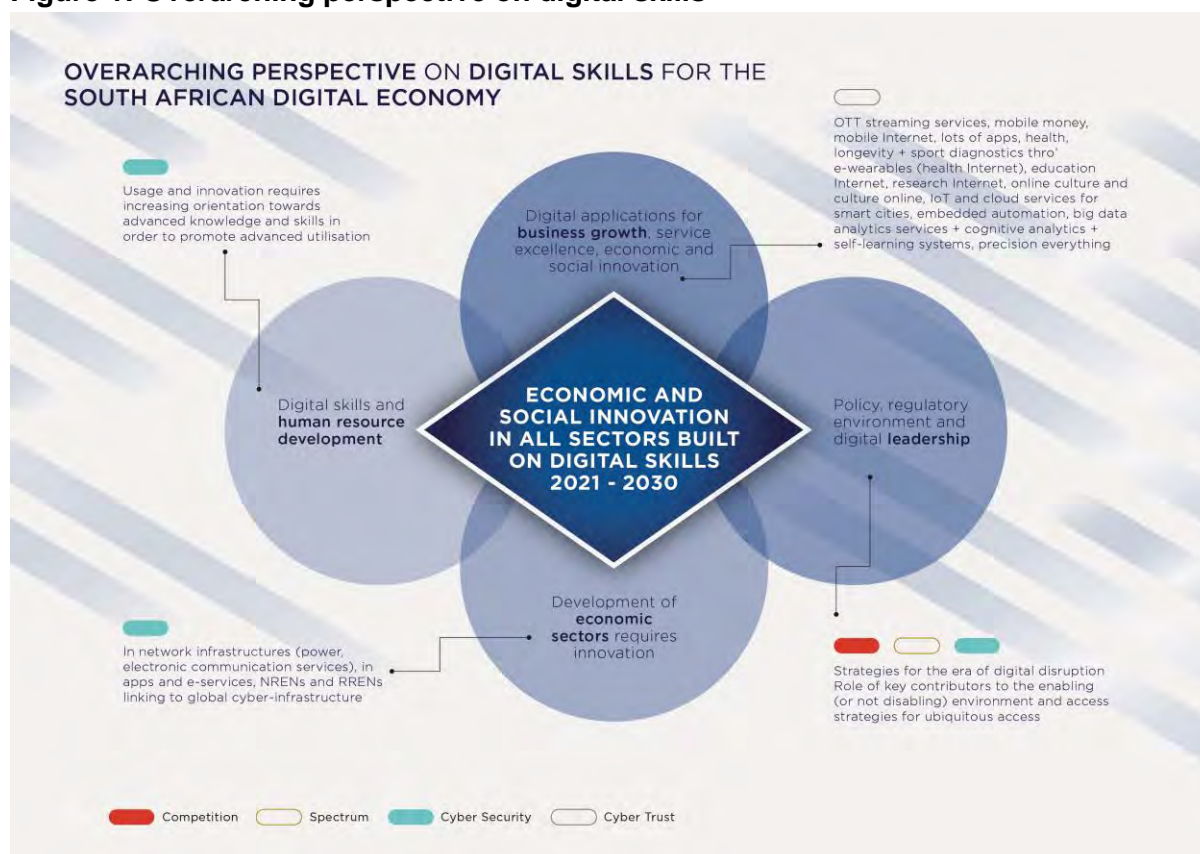
Source: Abrahams, 2021

In creating the more in-depth processes for implementation of digital skills development, organisations must step forward to produce the many highly specific implementation planning documents that are needed, at sectoral level, and at organisational level, to supplement this document and provide greater detail to this complex endeavour.

3. Programme Theory of Change: STEAMIE, Gender Balance, Persons with Disabilities and YNEET

A key word in the digital era is "disrupt", including *disruption in how* people function, in how institutions function, in how government functions, in how the economy functions and in how society functions, not only in technology terms. The associations between humans and technology, the *techno-human interaction*, gives rise to new modalities of behaviour, *new ways of being human*. To fully experience these new lives and lifestyles, the institutions that enable economy and society must themselves be disrupted. In particular, *government bureaucracies must become agile and enabling*, and must *accelerate and deepen* their current programmes in fostering digital skills. With respect to the new dimensions of digital and future skills development, government and its many stakeholders and partners must *institutionalise and embed* new skills programmes, in ways that encourage *breakthroughs* and *shape shifting*.

With respect to the details of this implementation programme, three major breakthroughs are needed (i) *investing time, human effort and funding in producing strong* science, technology, engineering, arts, mathematics, innovation and entrepreneurship *(STEAMIE) foundations* for digital and future skills at the basic education and post-school education phases; (ii) *investing time, human effort and funding* in shifting the inertia that pertains in the South African economy *with respect to young people not-in-employment-education-or-training* (YNEET); and (iii) ensuring that there is *equitable access to foundational STEAMIE skills* by women and girls, by persons with disabilities, and by YNEET. The principles and intent of *universal access design*, must underlie implementation. While all aspects of implementation are important, these three focus areas could enable South Africa to *shape shift*, from a declining economy with marginalisation of a large proportion of its population, to an economy becoming increasingly more empowered and becoming more socially and economically inclusive, see STEAMIE diagram Figure 2.

Figure 2: STEAMIE skills sets (science, technology, engineering, arts, mathematics, innovation and entrepreneurship)
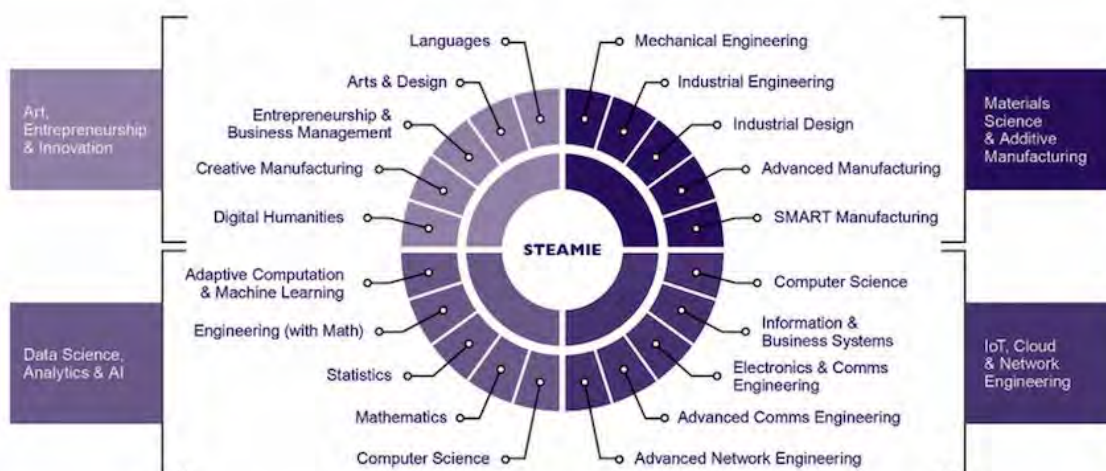
Source: Burke & Abrahams, 2021

STEAMIE (science, technology, engineering, arts, mathematics, innovation and entrepreneurship): From STEM to STEAMIE

Moving from the more traditional focus on the importance of science, technology, engineering and mathematics (STEM) skills, South Africa's industry, governmental, non-governmental and education and training sectors need to focus on building our human capacities for enabling the arts and creative industries to mainstream the use of digital applications and visualisations, and for building the kinds of digital skills that are useful for continuous innovation and even more dynamic entrepreneurship, shifting to **STEAMIE**. A review of other national level digital skills programmes (India, Canada, amongst others), and a review of certificate and degree programmes at technical training institutions and universities across the globe, reveals that arts, innovation and entrepreneurship are key features of contemporary education and training, in addition to STEM. Much greater attention must be paid to building creative digital skills, digital innovation skills, and digitally-enabled entrepreneurship amongst women and girls, persons with disabilities, and YNEET, in order to promote digital skills equity. This approach to change is embedded in the implementation programme elements and interventions.

Implementation Programme Elements and Interventions

For each strategy element, the programme sets out the challenge and status for that particular element, as well as the change and measures required. Relevant implementation measures are then offered. Finally, in section 13 below, a simple implementation matrix sets out the inputs, major activities, desired outputs, as well as the expected outcomes and impact for each strategy element. Each of the major sections includes a visualisation responding to the question: What measures must we implement? Each visualisation points to measures, activities and outputs, as well as to the relevant stakeholders who should focus on those measures. Carry these visualisations with you, as you adjust and adapt existing activities, and introduce the new measures and activities, required for growing South Africa's digital and future skills. Introduce further innovation and new ideas, over and above the measures set out here.

Implementation Programme Change Management

Active change management must be applied, with respect to translating this theory of change into the South African reality of change. Such change management techniques must include (i) foresight exercises to diagnose implementation challenges and design responses and (ii) continuous collaboration between government and key stakeholders in digital skills building, as well as collaboration across the broad community of stakeholders, with digital leadership being exercised by government, industry, the non-governmental sector and the skills building sector.

4. Strategy Element 1: Digital and Future Skills Foundations

Digital Foundations: Challenge and Status

Science, technology, engineering, arts, mathematics, innovation and entrepreneurship (STEAMIE) serve as the foundations for meaningful participation and productivity in the 21st century economy. In addition, 21st century (future) skills are required in combination with STEAMIE, including *learning skills* (creativity and innovation; critical thinking and problem

solving; communication and collaboration), *literacy skills* (information literacy; media literacy; ICT literacy), and *life skills* (flexibility and adaptability; initiative and self-direction; social and cross-cultural skills; productivity and accountability; leadership and responsibility).

Foundational reading and numerical skills are critical for any future learning and knowledge construction since these enable higher cognitive reasoning and problem-solving, and skills acquisition in this regard cannot be leapfrogged (Reddy et al., 2019). These foundations need to be laid where the most significant impact can be made from early learning in the early childhood development (ECD) sector through to the senior phase of schooling.

The schooling system, faces many challenges, for example, while average mathematics achievement did improve between 1995 and 2015, there are significant inequalities: noting that 3% of high schools (200) produce more mathematics distinctions than the remaining 97% (6, 600) (Spaull, 2019). While there has been improvement in reading outcomes, 78% of Grade 4 children cannot read for meaning in any language. Outcomes are marked by income disparities, as a child in the wealthiest 10% of schools is five times more likely to learn to read at a basic level by Grade 4 than a child in the poorest 50% of schools.

Performance in mathematics achievement and reading outcomes should be addressed in the light of access to critical resources, including access to the Internet. According to the School Monitoring Survey, in 2017, access to the Internet by secondary school principals, teachers and learners was 68%, 59% and 21% respectively (DBE, 2020a). The survey indicates that 64% of Grade 12 learners in public schools have computer laboratories. The percentage of Grade 12 learners who take one of the two computer subjects, Computer Applications Technology (CAT) and Information Technology (IT), has remained around 6% for many years (20% in Quintile 5 against 2% in Quintile 1) (DBE, 2020a).

Digital Foundations: Measures, Activities, Outputs

Achieving success on **Strategy Element 1: Digital Foundations** in the next five years (2021 – 2025) requires designing local applications and content, using freely available applications, and continuously revising curricula, using digital content to adapt quickly and continuously to changing knowledge needs; building capacity to ensure all educators are empowered with digital skills and that these skills remain current; and providing access to broadband connectivity and other supporting infrastructure that enables digital skills.

The recommendations by the Presidential Commission on the Fourth Industrial Revolution (PC4IR) implores South Africa to build digital and 21st century skills, and calls for the initiation of changes that are catalytic by investing in STEAMIE education and in doing so, identifying the "pivot point" to bring about the desired change (Republic of South Africa, 2020). Changes must be introduced in ways that ensure sufficient "curriculum stability to ensure that the recent trajectory of improvements in key subjects such as languages and Mathematics continue" (DBE, 2020: 17). In other words, changes must be introduced in a manner that improves the cognitive capabilities of learners to support the improvement in mathematics and reading outcomes, including digitally supported teaching and learning. Each implementation measure discussed below incorporates inputs and major activities, acknowledging major activities currently in process, and adding further value-added activities.

DIGITAL AND FUTURE SKILLS FOUNDATIONS
What measures must we implement?

YOUNG PEOPLE HAVE THE SKILLS TO FUNCTION EFFECTIVELY IN ANY PART OF THE 21st CENTURY ECONOMY AND SOCIETY

1 CURRICULUM INNOVATIONS

2 DIGITAL PEDAGOGICAL KNOWLEDGE OF TEACHERS

3 INFRASTRUCTURE AND CONNECTIVITY IN SCHOOLS

Curriculum Innovations
- Digital curriculum in ECD, foundation to senior phases
- Unlock entrepreneurial mindsets
- Educational digital application

Digital Pedagogical Knowledge of Teachers
- Training on Professional Development Framework for Digital Learning — **15 000** teachers trained
- Training teachers on digital pedagogy
- Teacher development across subjects — **2 000** math teachers trained on dynamic software
- Communities of Practice on digital pedagogy and mathematics
- **1 000** subject advisors participating

Infrastructure and Connectivity in Schools
- Digital learning support materials
- **60%** of learners have access to the internet in schools
- DBE cloud
- Zero-rating data
- Full digital school ecosystem
- Universal service and access obligations

ACTIVITIES AND OUTPUTS

STAKEHOLDERS INVOLVED IN THE MEASURE:

- DBE
- DSD
- DHET
- SACE
- HEIs

Girls, boys, and learners with disabilities must be encouraged to participate in digital skills development and, conversely, curriculum innovation and training in digital pedagogy must provide for greater accessibility to digital skills foundations, in a well-integrated loop. Open source software design can promote accessibility, while eduplaytion applications can enhance learning amongst all learners with varying cognitive development needs.

Digital Foundations Implementation Measure 1: Curriculum Innovation

The Department of Basic Education (DBE) is piloting coding and robotics in Grade 1 to 3 in 2020/21, and is developing the curricula for the General Education and Training (GET). The University of South Africa (UNISA) has made available 24 ICT laboratories for training 72,000 teachers, with plans in place to train at least 3 teachers in each of the 16 000 primary schools to teach coding (DBE, undated). The rollout will be supported through the introduction of an AI-based educational platform, Ms Zora, which is anticipated to reach 70% of the 24 000 schools in the country by 2023 (Malinga, 2020).

The *rollout of digital literacy, coding and robotics in the curriculum* from foundation to the senior phase is a cornerstone in the implementation programme and needs to be supported by all stakeholders. The curriculum focuses on several critical variables, including application skills; Internet and e-communication skills; data and information management skills; and computational thinking skills and coding. It includes the integration of 21st century skills such as creativity, collaboration, and problem solving. The DBE has established a team of experts in the fields of CAT and IT to prepare the digital skills curriculum from Grade R to Grade 9, with piloting commencing in 2020 for Grade R, Grades 4 – 6 during 2021 and Grades 7 – 9 during 2022 (DBE, 2019). As part of this process, the development of the necessary learning and teaching material and the training of teachers have been prioritised. The DBE must continue to drive this process, in collaboration with strategic partners such as the Provincial Departments of Education, and South African Council of Educators (SACE).

The DBE is also piloting the E[3] (Entrepreneurship, Employability and Education) initiative to *unlock an entrepreneurial mindset* among learners as part of developing 21st century skills. This initiative is geared towards project-based learning and gamification of learning, with respect to the existing CAPS curriculum, to better prepare learners for the digital economy. The pilot phase to 2021 is testing the E[3] approach and core interventions, including its learning methodologies such as project-based learning (PBL) in a sample of schools, teacher training and teacher support (DBE, 2019). The full-scale rollout of this approach in all schools following the pilot phase is another cornerstone towards the foundations necessary to develop not only digital skills but also 21st century skills. The initiative is delivered in partnership with Care for Education (CfE), Community Individual Development Association (CIDA), the National Education Collaboration Trust (NECT) and New Leaders Foundation (NLF).

These initiatives must be complemented by the introduction of educational digital applications in all subjects, through all the phases of learning, to enhance understanding and capability with respect to subject matter knowledge, as well *cyber secure conduct in schools*. These applications introduce benefits into the teaching and learning process and experience, as extensive information can be sourced, stored, organised, and manipulated to make it easier to absorb, a major advance over the traditional text-book. Benefits flowing

from the use of these applications include improved comprehension of structure and connections, exploration of concepts, re-description of concepts, concretising theory through practice, and enhanced knowledge construction (Ndlovu, 2015). As a first step, a review and critical evaluation must be undertaken to assess the most appropriate digital technologies for specific subjects in the curriculum. Thereafter consideration must be given to how these technologies can be introduced into the curriculum, taking into consideration access to the Internet, and the availability of devices and applications in schools.

With respect to promoting a reasonable degree of equity for persons with disabilities, building STEAMIE skills in education must apply to children with disabilities (in ECD), and to learners with disabilities (in school). Learning-friendly applications and open online courses can be designed to take care of the needs of specific types of disability, noting that digital applications are highly amenable to adaptation. ***Functional computer access is a key required investment in special needs schools***; and technologies in the reality-virtuality (RV) continuum, which include augmented reality and virtual reality, should be adopted as valuable aids for teaching digital and future skills in special needs schools.

Teachers will be the facilitators and thus, require extensive training in the use of identified educational digital applications. The DBE, once again, is a lead agent in this change process, together with the DHET, and university schools and faculties of education.

The development and implementation of a ***digital literacy curriculum for early learning***, targeting the Early Childhood Development (ECD) sector, is required to support the various initiatives aimed at strengthening this sector. This must be integrated into the ongoing efforts to provide early learning services in the ECD sector. Key areas of learning supported by digital technology include communication and collaboration, cognitive development, creativity, socio-dramatic play, and learning to learn (UNESCO, 2012). Despite this potential, available data suggest that just over 21% of children aged birth to two years are enrolled in a group programme for learning, with another 9% in the care of a day mother, child-minder or gogo, and the remaining 70% likely to be cared for by their mothers or family members. Nearly 1.1 million children aged three to five years are without access to any form of early leaning programme (Hall et al., 2019). Stakeholders in the ECD sector will need 100 000 new early learning practitioners and assistants, and more than 40 000 new venues to close this gap (SmartStart, 2020). Many new digital applications will be needed for the ECD sector, note for example the recent integration of messaging promoting early learning into the department's mobile messaging platform, MomConnect.

Efforts to ensure that an adequate number of appropriately qualified human resources are available are guided by the Human Resources Development Strategy for Early Childhood Development (DBE, 2018). The development of a digital literacy curriculum that can support a range of technological artefacts in low resource environments and support innovative teaching and learning practices for early learning is required. This can potentially be integrated into the existing curriculum components of the Occupational Certificate: Early Childhood Development Practitioner, but should also be flexible enough to be incorporated in a range of less structured training for practitioners (many of whom may be excluded from accessing a qualification at NQF Level 4 owing to their own exclusion from the formal education system). Micro-courses and micro-credentialing is an approach that is suitable here. Furthermore, this must be accompanied by the development and rollout of learning resources appropriate for both centre-based and non-centre-based early learning. The DBE,

in collaboration with the Department of Social Development (DSD) and the Department of Health (DoH), as well as Community Health Workers supporting early childhood development, and in partnership with the Education and Training Sector Education and Training Authority (ETDP-SETA) and other social partners such as StartSmart, are key stakeholders in this regard.

Digital Foundations Implementation Measure 2: Building Digital Pedagogical Knowledge of Teachers

The successful rollout of curriculum innovations that use digital tech to improve the quality of learning and learning outcomes is dependent on teachers having the relevant digital skills and pedagogical knowledge.

For this reason, a large-scale ***training programme on the Professional Development Framework for Digital Learning*** *(PDFDL)* is required to strengthen the digital pedagogical capabilities of teachers (DBE, 2018). A key aim of this Framework is ensuring professional development in the use of digital technologies that enhances teaching and learning, as well as enabling the process for doing so by leaders and support staff. The Framework is targeted at teacher trainers, school leaders and teachers, e-learning specialists, and curriculum subject specialists. The DBE has, in support of rolling out the Framework, developed teacher, provincial and district toolkits aimed at empowering all levels of the sector in supporting the implementation of the Framework in their respective provinces. The full-scale rollout of the Framework across all education districts must be put on fast-forward over the next five years, to ensure the development of digital pedagogical competencies in schools. The DBE must continue to lead this process in collaboration with SACE and DHET, while higher education institutions' (HEIs) faculties and schools of education must build the competencies of digital pedagogy amongst future teachers. The ***establishment of provincial and district level communities of practice (CoPs) for building digital pedagogy***, targeting school subject advisors, will make an important contribution to supporting the development of digital pedagogical competence across the country.

In order to deepen these capabilities, ***digital pedagogy integration into the curricula for teacher education*** in higher education institutions is required. The DHET should lead a process to determine the scope and quality of digital pedagogy coverage in undergraduate and postgraduate teacher education qualifications in South Africa higher education institutions (HEIs). A first step in this process is the convening of a conference on digital pedagogy in teacher education to which all the faculties, schools and departments of education in HEIs should be invited, with the objective to critically review the scope and quality thereof. This should become an annual conference, geared to the formulation and continuous review of a roadmap for strengthening the scope and quality of digital pedagogy in the teacher education and development curriculum.

The design of ***teacher professional development training programmes in many subjects*** for Grade 8 to Grade 12, must aim to enable the use of powerful language learning software (using applications for first and second language education, like the free Duolingo software for early language learning, very relevant for learning a second language), as well as applications in dynamic software for mathematics learning (like GeoGebra and The Geometer's Sketchpad), geography apps and websites (like the free app Planet Geo, or the

freely accessible National Geographic Education, or Google Earth VR) and other apps and content across the full school curriculum. To support ongoing teacher professional development, in particular in mathematics, it will be of great value to establish **communities of practice (CoP) for maths teachers at secondary school level**, as these can provide opportunities for the applied use of digital technology in teaching practice. The many freely available applications that can support mathematics teaching and learning include GeoGebra, Math Mechanixs, Calc 3D Pro, LiveMath Viewer, Mathematica Player and GraphSketch, among others. The design and offering of training programmes for using maths apps must be available to secondary schools in all provinces. The establishment of maths teachers' communities of practice are a critical endeavour to support social learning, collaboration and peer support among teachers.

Digital Foundations Implementation Measure 3: Ensuring Broadband Connectivity and Quality of Service for Using Digital Applications in Schools

Curriculum innovation and building digital competencies requires broadband connectivity, with quality of service, and availability of devices for teachers and learners. Curriculum innovation requires schools to effectively use digital applications to augment, modify and transform the teaching and learning experience, in order to increase the success rate of learners in all subjects. A schools broadband partnership, with participation from industry and government, should invest in deployment of broadband connectivity to promote effective use of digital Learning and Teaching Support Materials (LTSM) and increased usage of DBE Cloud (https://dbecloud.org.za/login/welcome.php). School connectivity should enable the use of powerful and dynamic software, as well as access to learning apps and websites. Over and above these resources, is access to local school content initiatives such as the Digital Classroom (www.digitalclassroom.co.za/) offered by Vodacom and the educational platform Sentech Learn, Connecting our Youth in a Digital Age https://sentech.tv/.

While nearly 18 000 schools have been connected to the Internet, only 8% have access to high speed connectivity. The digital technology rollout plan of the DBE is set to connect 26 703 schools by 2024 (DBE, 2020), noting that the full digital school ecosystem needs to be designed, established, maintained and advanced, over and above connectivity. Negotiating formal agreements for zero-rating access to a relevant list of educational content and services, such as those mentioned above, is essential. The design of Universal Service and Access Obligations (USAO) by the regulator ICASA, in consultation with the DBE, and creative broadband access to schools' initiatives by telecommunications network operators, also in consultation with the DBE, in ways that address the multiple levels of the digital divide, must be facilitated. In parallel, education districts and school principals must play an even greater role then before, in promoting digital connectivity in schools, including as part of school-fundraising activities.

Table 1: Digital Foundations: Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To expand the digital competencies in schools for improving the cognitive abilities of learners	• Enhanced cognitive capabilities of learners in basic education, with particular attention to gender equality
Measures	**Outputs**

• Enable curriculum innovation focusing on digital literacy, coding and robotics, and 21st century skills in basic education	• Integrated digital literacy, coding and robotics from Grade 1 – Grade 9 in all public schools • 21st century skills (E³) integrated into the CAPS curriculum • Educational digital applications integrated into six (6) school subjects in secondary school • Developed a digital literacy curriculum framework for the ECD sector • Communities of practice for maths teachers established in each schools circuit, of each education district, in each province • Increased the number of Grade 12 learners taking one of the computer subjects (CAT or IT) at public school • Introduce augmented and virtual reality applications for special needs schools for learners with disabilities
• Strengthen the digital pedagogical capabilities of teachers	• A minimum of 15 000 teachers trained in terms of the PDFDL • Digital pedagogy integrated as a subject into the teacher education curricula at HEIs • A minimum of 2 000 mathematics teachers trained in the application of dynamic software • A minimum of 1 000 subject advisors participating in communities of practice on digital pedagogy • University consortium established specializing in digital pedagogy innovations for teacher and subject advisor development
• Promote access to Internet connectivity digital infrastructure, facilities and educational resources	• 60% of learners have access to the Internet in schools • Increased access to e-LTSM

5. Strategy Element 1 & 2: Intermediate and Advanced Digital and Future Skills

Intermediate and Advanced: Challenge and Status

The Post-School Education and Training Sector (PSET) and wider innovation ecosystem provide the crucial skills development infrastructure for developing intermediate and advanced digital skills. The *National Digital and Future Skills Strategy* identifies the need for clarifying the roles, inputs and outputs of the Post-School Education and Training Sector (PSET) and wider innovation ecosystem. In particular, it is widely recognised that digital technologies open new opportunities for the Technical and Vocational Education and Training (TVET) sector, and it is crucial that these institutions embrace such technologies and regard the production of digital skills as one of their contributions to enhancing the individual and collective capacities of current and future labour markets (ILO, 2020). In this context, the PC4IR calls for rethinking the role of TVET colleges as micro-learning institutions, providing 21st century relevant competencies, in ways that contribute to the development of the required occupational skills for the future workplace (RSA, 2020a).

Universities are expected to make a significant contribution to the development of advanced digital skills. The *National Digital and Future Skills Strategy* implores universities to accelerate their contribution to advanced digital skills, through creating digital bilinguals in every degree programme and short course. Unfortunately, the number of students attaining qualifications in the relevant disciplines and fields remain small compared to the demand in industry, contributing to the digital skills gap. In the TVET subsystem, for instance, only 20% of students graduate with a National Accredited Technical Education Diploma (NATED) and National Certificate Vocational (NCV) in engineering programmes (National Planning Commission, 2020). In 2018, the total students registered for an *Engineering and Related Design* qualification were only 9 050 (L2 – L4), of which 1 133 (46.3% completion rate) registered, wrote and completed; *Information Technology and Computer Science* students

were 7 119 (L2 – L4) of which 415 (40.1% completion rate) registered, wrote and completed; and *Mechatronics* students were 840 (L2 – L4) of which 84 (61.3% completion rate) registered, wrote and completed (DHET, 2020a). These low success rates must change.

In the university subsector, 1,085,568 students enrolled in public higher education institutions (including 400,499 distance students) of which 320,671 (29,5%) were enrolled in Science, Engineering and Technology (SET) in 2018. SET graduates in 2018 were 17,418 at undergraduate level, 5,015 post-graduate below Master's level, 3,333 at Master's level, and only 713 graduated with Doctoral degrees. There are emergent pockets of HEI academic and research capabilities in digital arts, entrepreneurship and innovation; data science, analytics, and machine learning; IoT, cloud and network engineering; and materials science and additive manufacturing, dispersed across university system and science and innovation institutional infrastructure. For example, Sol Plaatje University offers an undergraduate programme in data science, while the Department of Science and Innovation and the National Research Fund (DSI-NRF) Centre of Excellence in Mathematical and Statistical Sciences (CoE-Mass) was established in 2014. The CoE-Mass, among other focus areas, includes Machine Intelligence and Learning from Experience (MILE) directed at theoretical and practical principles of artificial intelligence and their applications to real-world problems. A number of NRF South African Research Chairs Initiative (SARChI) also support the growth of these fields. Now, a growing number of universities are offering data science degrees at postgraduate level.

South Africa has a growing network of innovation spaces, including digital hubs, tech-hubs, co-labs, maker spaces, and innovation hubs that support digital entrepreneurship. These innovation spaces are an important node in the ecosystem for advancing digital entrepreneurship. They represent interconnected entrepreneurial actors, organisations, institutions, and entrepreneurial processes, which formally and informally connect, mediate and govern the local entrepreneurial environment (OC&C Strategy Consultants, 2018). They facilitate the evolution of real digital entrepreneurship through acquiring digital and 21st century skills (DCDT, 2020). A common feature is that they are collaborative working spaces and competence building centres, where participants use digital technology to create business start-ups, and improve and grow existing businesses (Kedama & Abrahams, 2017).

Intermediate and Advanced: Measures, Activities and Outputs

Strategy element two of the *Digital and Future Skills Strategy of South Africa* is focused on strengthening the post-school knowledge system and ecosystem of innovation spaces to facilitate digital entrepreneurship. Furthermore, the PC4IR (RSA, 2020) entreats us to take a comprehensive view of the entire human capital system, in which leverage points must be identified to accelerate 21st century capability building. The need to inject greater relevance into the TVET system must be addressed, towards such capability building, ***particularly for young women, young persons with disabilities and YNEET***. The focus must be on delivery of digitally-oriented programmes and qualifications, the development of institutional specialisations, while at the same time scaling access to these programmes. This must be accompanied by improved coordination, alignment and concentration of resources in ways that unleash this capacity for the benefit of society and enable digital transformation of PSET institutions themselves.

INTERMEDIATE AND ADVANCED DIGITAL AND FUTURE SKILLS

What measures must we implement?

GRADUATES (PARTICULARLY WOMEN AND GIRLS) HAVE DIGITAL SKILLS-ORIENTATED QUALIFICATIONS AND DIGITAL BUSINESSES SHOW INCREASED START-UP AND GROWTH

1
FUTURE-ORIENTATED SYSTEM

2
HEIs USE A PLATFORMS FOR ADVANCED DIGITAL SKILLS DEVELOPMENT

3
VIBRANT ECOSYSTEM FOR DIGITAL ENTREPRENEURSHIP

1

Implement NCV-IT and CS curriculum

Build qualifications and institutionalisation specialization — **10** TVET colleges specialising in offering digital qualifications

Improved TVET lecturer qualifications — **2 000** TVET lecturers trained in digital pedagogy

Recruit more students into STEM/STEAMIE qualifications — **30%** increase in NCV-IT, Engineering, and Mechatronics enrolment and completion

2

Establish a platform to offer MOOCs in STEAMIE graduate programmes — **20%** increase in STEM graduate and postgraduate enrolment and success rate

Establish university consortia in ICT and data science fields — **4** university-TVET-industry consortia established

NRF privately funded chairs in in university — **5** research chairs established in 4IR niches

3

Digital hubs programme — **20** digital hubs

Stakeholder's ecosystem platform

Business development services and finance — **10 000** potential and existing entrepreneurs trained

ACTIVITIES AND OUTPUTS

STAKEHOLDERS INVOLVED IN THE MEASURE:

● DHET   ● DTIC   ● TVETs   ● NRF   ● HEIs

Intermediate and Advanced Digital Skills Implementation Measure 1: Building a future-oriented TVET subsystem

A series of interventions is required to build the future-readiness of the TVET subsystem.

Firstly, the ***implementation of the revised National Certificate (Vocational) Information Technology and Computer Science (NCV-IT&CS) curriculum*** must be undertaken as a matter of priority. The review of the curriculum has been completed and will be implemented through a phase-in and phase-out process. This follows the prioritisation of this qualification for review in 2018 and the establishment of Curriculum Support Teams comprising of subject experts and industry stakeholders. The DHET also worked with the Tshwane University of Technology (TUT) IT Faculty to develop a Robotics specialisation in the NCV-IT&CS. Implementation of the revised curriculum also requires commissioning and evaluation of textbooks and training of lecturers. The implementation of the revised curriculum is scheduled for 2021. The DHET has further partnered with the Cisco Networking Academy to update the Life Orientation component of the qualification to ensure that it covers, among others, the latest ICT developments in areas such as Introduction to Internet of Things, and Introduction to Cybersecurity. TVET colleges are currently registering as Cisco Network Academy Centres for the purpose of lecturer training and the implementation of the programme.

Secondly, the DHET needs to leverage the experience, networks and knowledge gained in the revision of the NCV-IT&CS and the development of the Robotics specialisation, together with the insights gained from the establishment of 26 Centres of Specialisation (CoS) at 19 TVET colleges, to ***build further specialisations in the qualification, as well as institutional specialisation*** respectively. Additional specialisations to be considered should include data analytics, network engineering, and design for additive manufacturing. Although the Centres of Specialisation programme for TVETs is dedicated to developing skills for specific artisan trades, consideration should be given to leveraging the approach adopted to develop TVET specialisations for digital skills. This will require the development of qualifications for digital technology-oriented occupations under the guidance of the Quality Council for Trades and Occupations (QCTO). Moreover, such an approach must contribute to differentiation based on digital programme offerings within the TVET subsystem.

Thirdly, the quality of the programmes is dependent on ensuring that appropriately qualified lecturers are available to teach. This will require a significant investment in ***upgrading and enhancing the qualifications of TVET lecturers***, not only in the specific digitally-oriented programmes, but also in strengthening their digital pedagogical competency. The professional and post-professional qualifications for TVET lecturers must integrate a focus on digital pedagogy, in line with efforts to introduce a minimum set of requirements for TVET lecturers (DHET, 2013) and the strategy for TVET lecturer development currently under preparation (ETDP-SETA, 2019).

Finally, the focus on enhancing the relevance of the NCV-IT&CS, and strengthening specialisations in the TVET subsystem, must be accompanied by a ***targeted campaign to recruit more students*** into the *Information Technology* and *Computer Science* fields, *Mechatronics*, and *Engineering and Related Design* qualifications. This targeted campaign promoting awareness of the significance of these programmes, as well as focused

recruitment drives among **young women, young persons with disabilities and YNEET as potential students**, and making available funding to support greater numbers of young people accessing these programmes, both at institutions and online.

Intermediate and Advanced Implementation Measure 2: Strengthening Higher Education as a Platform for Advanced Digital Skills Development

One of the most important initiatives for the evolution of a secure digital economy in South Africa is the **intermediate and advanced education and training in cybersecurity**, with work on OFO (Organising Framework for Occupations) codes for specific occupations in the field of cybersecurity currently in design; and initial work on the design of a junior qualification by the MICTSETA. Universities must work on the design of degree programmes, or the adaptation of existing degree programmes in the computing, software engineering, information systems, and management sciences, to **prioritise undergraduate and postgraduate education and postgraduate research in the field of cybersecurity**, understanding that effective cybersecurity education requires both a technology perspective and a management perspective. Furthermore, the basics of cybersecurity should be included, where relevant, in degree programmes in the education sciences, in the health sciences, and in other disciplines at risk for cyber vulnerability.

The interventions to strengthen higher education as a platform for the development of advanced digital skills include the use of Massive Open Online Courses (MOOCs) and content streaming for STEAMIE disciplines; growing postgraduate niches in digital arts, entrepreneurship and innovation; data science, analytics, and machine learning; IoT, cloud and network engineering; and materials science and additive manufacturing; and targeting funding to NRF and privately-funded chairs focusing on these fields, in universities.

The DHET launched its National Open Learning System (NOLS) in 2019 to make available self-directed learning materials and self-evaluation tools in order to increase access to learning opportunities. Furthermore, the DCDT through its implementing agency, the National Electronic Media Institute of South Africa (NEMISA), partnered with Coursera, an international MOOC provider established by Stanford University, to offer free courses to young people in the fields of data science, coding, applications development and artificial intelligence. These initiatives need to be harnessed to **establish a platform to offer MOOCs targeting graduate programmes in STEAMIE disciplines**. A university consortium must be established to convert the top graduate programmes in science, engineering and mathematics offered at South African universities and to offer these as freely accessible open online courses. These programmes will provide an opportunity to concentrate scarce academic resources for the purposes of supporting student access and success in these disciplines. The platform should not only provide the digital infrastructure for hosting the online courses, but also support the consortium in designing and producing the courses for online delivery, with continuous upgrades.

There are pockets of niche capabilities for digital skills, emerging in the higher education, science and innovation institutional landscape. A good example of this is the capability that has emerged in respect of additive manufacturing in the form of a Centre of Competence in Additive Manufacturing. This competence is spread across a number of higher education institutions and science councils focusing on process and product development; design

simulation and modelling; materials development and characterisation; and human capacity development. These specialist capabilities are applied in different industries, including advanced tooling, medical implants and devices and aero-structures (du Preez & de Beer, 2015). Drawing on this approach, there is a need to ***develop postgraduate university niches through the establishment of university consortia in digital arts, entrepreneurship and innovation; data science, analytics, and machine learning; IoT, cloud and network engineering***. University and science council consortia should be invited to submit proposals for the establishment of these niche centres of competence.

A further measure to harness and strengthen existing capabilities are the ***establishment of targeted NRF and privately-funded chairs in universities focusing on specific fields*** in (1) digital arts, entrepreneurship and innovation (2) data science, analytics, and machine learning; (3) IoT, cloud and network engineering; and (4) materials science and additive manufacturing, across the university system and science and innovation institutions, and advancing the much-needed research capability at the tertiary level. These are strategic interventions that attract and retain research excellence and innovation at public universities, science councils and national research facilities. Bursaries should be provided to encourage postgraduate students, ***particularly young women, young persons with disabilities and YNEET***, to undertake their studies in these fields in terms of the NRF Postgraduate Student Policy.

Intermediate and Advanced Implementation Measure 3: Promoting a Vibrant Ecosystem for Digital Entrepreneurship

The promotion of a vibrant ecosystem for digital entrepreneurship will be centred on the rollout of the Digital Hubs Programme implemented by the DTIC and its implementing agent, the Small Enterprise Development Agency (SEDA); knitting together the various networks in the digital entrepreneurship ecosystem to provide seamless support; and the delivery of digital entrepreneurship and business development services to promote successful business start-up and acceleration.

The Digital Hubs Programme (DHP) seeks to create a central meeting point for technology, innovation and creative businesses. These hubs serve as training centres for community members, provide access to facilities, and incubation for mainly young entrepreneurs operating in the digital economy. The hubs will be located inside the state-owned industrial parks that are currently supported by the DTIC under the revitalisation programme, and consist of a cluster of technology, digital media and Internet companies. The ***rollout and scaling up of the digital hubs programme*** forms an important part of the support that brings together digital skills and entrepreneurship development, technology and innovation.

The digital hub is only one form of innovation space. There are many others in the form of tech hubs, co-labs, makerspaces, fab labs and others that aim to bring together digital technologies, entrepreneurship and innovation. There are well-developed ecosystems in the Gauteng and the Western Cape Provinces, some independent operations and some with contributing funding from government. These ecosystems consist of a network of innovation-focused hubs, incubators, accelerators, universities and research and development centres (OC&C Strategy Consultants, 2018). The ***development of an ecosystem that brings together all the relevant stakeholders*** in a way that enables the seamless provision of

services to entrepreneurs in the digital economy, and advocating for their interests, is critical. The establishment of an ecosystem platform is an important step in this direction.

The quality of available digital entrepreneurship training in the public and private sectors, and the scale at which this can be accessed needs to be enhanced, in order to provide more entrepreneurs with the opportunities to enter and grow their digital businesses. This means *providing targeted business development services and finance* to a large number of potential and existing entrepreneurs in the digital economy.

Table 2: Intermediate and Advanced Digital Skills Development: Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To develop intermediate and advanced digital skills through the post-school education and training and innovation ecosystems	• Increased the number of graduates completing digital skills-oriented qualifications in the PSET system, with particular attention to women and girls • Increased digital business start-up and growth, emphasising inclusion of women and girls, young persons with disabilities and YNEET
Measures	**Outputs**
• Enhance the relevance of the TVET subsystem to the needs of the digital economy and society	• Implemented the re-curriculated NCV-IT offered across TVET system • Developed robotics, data analytics and coding as specialisations in the NCV-IT • 30% increase in NCV-IT, Engineering, and Mechatronics enrolment and completion • 2 000 TVET lecturers trained in digital pedagogy • 10 TVET college specializing in offering digital qualifications
• Strengthen higher education capabilities in STEAMIE disciplines	• Cybersecurity education and training prioritised through specialist degree programmes (computer science, engineering, information systems, management degrees) and integration of cyber awareness in a wide range of degree programmes and short courses • 20% increase in STEAMIE graduate and postgraduate enrolment and success rate • 4 university-TVET-industry consortia established (digital arts, entrepreneurship and innovation; data science, analytics, and machine learning; IoT, cloud and network engineering; and materials science and additive manufacturing) • 5 Research Chairs established in digital innovation niche areas
• Increase access to digital entrepreneurship services to potential and existing entrepreneurs for the digital economy	• Supported digital innovation for government applications at 20 Digital Hubs • Established an innovation system coordination platform • Innovation spaces offering digital entrepreneurship skills development programmes • 10 000 potential and existing entrepreneurs trained in digital entrepreneurship

6. Strategy Element 3: Digital and Future Skills for Workplace 4.0 (Digital Industry and Digital Government)

Workplace 4.0: Challenge and Status

South Africa is grappling with its capability to effect the changes associated with the emerging techno-scientific revolution, most notably around the relevant skills needs across a range of digital technologies and their applications in industry, business, government and the non-governmental workplace. South African organisations must establish a pathway that steers away from pitting people against robots, automated systems and machines that learn,

towards a pathway in which people collaborate with new technologies (NEDLAC, 2019). In the case of robotics, this is referred to as collaborative robotics, or co-botics. The relevant skills are required to address some of the key changes in production systems in manufacturing, which include the digitalisation and integration of supply chains; design, rapid prototyping and customisation; additive and advanced manufacturing and automation; and e-commerce and digital economy platforms (CCRED, 2019).

The digitalisation of manufacturing takes place at a time when South Africa is struggling to maintain its competitiveness in key sectors, following two decades of deindustrialisation, seen in the decline in the contribution of manufacturing to Gross Domestic Product (GDP) from 21% in 1994 to 13,3% in 2016 (CCRED, 2018). Capturing the opportunities of digital technologies fully is necessary to regain competitiveness, including through (CCRED, 2019):

- improving products and their digital content, changing product system functionalities, to move towards higher value product segments;
- diversifying products and activities by deploying digital industrial technologies transversally across sectoral value chains;
- increasing productivity via process upgrading along the value chain and the local production system;
- linking up with domestic and international firms, and diversifying market access; and
- developing industrial competitiveness in new global sectors by leveraging South African resources.

Bringing about these changes in the industrial production process and service sectors, including the financial services and logistics that support South African industry, will require a significant upscaling in the delivery of the required digital skills at foundation, intermediate and advanced levels. Estimates suggest that the forecast demand for people in digital and ICT roles in the short term is as many as 66,000 of which 45,000 are at entry-level jobs, noting that about 28,000 jobs are outsourced to other countries (Harambee, 2020). Many recent studies, including SETA sector skills plans, highlight skills in demand for roles in the following clusters (Harambee Youth Employment Accelerator, 2020; JCSE and IITPSA, 2019; WC DEDAT, 2019):

- data analytics (data analyst, data manager, database designer and administrator, business analyst, data centre operations specialist);
- software development (software developer, software development engineer, integrated systems developer, lead solutions architect);
- network engineering (computer network technician, systems analyst, computer network and systems engineer; network analysts, telecommunications network engineer, cloud specialist, integrated systems developer, network controller);
- cybersecurity (ICT security specialist, information security specialist); and
- visualisation and creative design.

Workplace 4.0 (Digital Industry and Digital Government): Measures, Activities and Outputs

The need to *scale up* digital skills development to meet industry needs points to the urgency of improving collaboration between industry and skills development institutions for more responsive digital skills development. Expanding workplace-based digital skills learning opportunities for young people is crucial in this regard, given the importance of work experience in the form of a portfolio of previous work, when moving to a new prospective employer (WC DEDAT, 2019). Digital skills development niches must be developed across the skills development ecosystem through the utilisation of the existing skills funding mechanisms. Identification of *opportunity zones* is necessary, since growth through digitalisation holds significant potential for job creation, such as in the globally traded services sector, in which there is the potential to create 100,000 new jobs by 2023 and 500,000 by 2030, all requiring foundational to intermediate digital skills (SADA, 2020).

The digital skills gap impacts the workplace in the private sector and in government. Inordinately slow progress towards digital government is compounded by the difficulties associated with retaining digital skills in the public sector, due to outdated systems and technologies and the inability to compete with the private sector for remuneration (PSETA, 2020). The public sector has progressively moved towards digital technologies across its systems and processes, but this has not been matched with the development of the skills to optimise the role of these technologies in the public service and to deliver digitally mediated public services (PSETA, 2020).

In the workplace context, the digital skills gap impacts women, persons with disabilities and YNEET in particular. *Women and persons with disabilities must be prioritised* in terms of equitable participation in workplace digital skills programmes. Young people not-in-employment-education-or-training should be offered digital and future skills learning opportunities in *"opportunity zones"* created in the private sector and in government, for a few hours per month, within what is allowed by the applicable labour law. Opportunity zones can present opportunities for digital and future skills relevant both to employment, and to entrepreneurship. The best workplaces for the establishment of opportunity zones are those workplaces that are undergoing digital transitions. A key section of this implementation programme is dedicated to YNEET, see section 8 below.

Similarly, within this broader initiative, *specialised opportunity zones should be designed, in collaboration with the many national and sectoral organisations for persons with disabilities* (such as National Council for and of Persons with Disabilities), to cater for their special needs in terms of skills development. The major challenges here will be online access and physical access. Hence, the specialist opportunity zones and digital skills centres should *use universal access principles in their design*, using accessible platforms and technologies, and employing the services of specialist facilitators. Digital and future skills, capacities and orientations can create opportunities for greater inclusion and greater participation in the workplace, supporting both independent and assisted living, and reducing economic vulnerability.

WORKPLACE 4.0 - DIGITAL INDUSTRY AND DIGITAL GOVERNMENT

What measures must we implement?

WORKPLACE 4.0: TRANSITION FROM WORKPLACE 1.0 (MECHANISATION) TO WORKPLACE 4.0 (EXTENSIVE DIGITISATION) AND BEYOND: MORE EMPLOYEES HAVE WORKPLACE-FOCUSED DIGITAL SKILLS

1
OPPORTUNITY ZONES AND DIGITAL SKILLS CENTRES

2
IMPLEMENTATION OF DIGITAL SKILLS DEVELOPMENT

3
WORKPLACE-BASED LEARNING
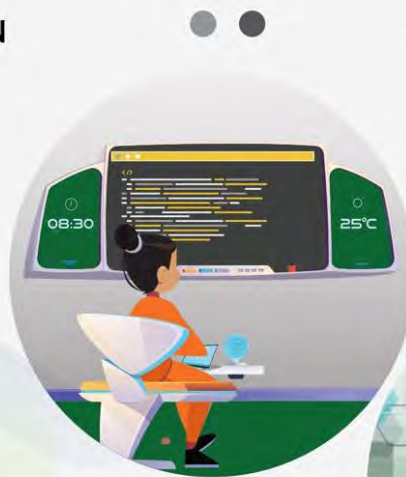
4
OPTIMISE VALUE OF DIGITAL SKILLS IN GOVERNMENT

Measure 1
- Digital skills development niches
- Partnerships with industry associations and professional bodies
- New and re-aligned qualifications

3 multi-stakeholder centres

Measure 2
- NSF to invest in digital skills development opportunities
- Start-up of TVET teaching chair programme

30% increase in certification in digital skills development opportunities

5 TVET Teaching Chairs

Measure 3
- Expand workplace-based learning
- Incentive schemes in workplace-based learning

Measure 4
- Government (PSET, NSG, DPSA) implement specialist digital skills programmes
- Digital literacy for frontline public servants
- Digital government programme for leaders and managers

3 specialist digital skills development programmes

ACTIVITIES AND OUTPUTS

STAKEHOLDERS INVOLVED IN THE MEASURE:

- DSI
- TVETs
- PSETA
- Public sector
- Private sector

Workplace 4.0 Implementation Measure 1: Establishing Industry-Led Digital Skills Opportunity Zones and Digital Skills Centres

Strong industry leadership is required to drive the establishment of a network of Digital Skills Centres, in collaboration with universities, TVETs, SETAs and skills development providers. These centres should not be considered as singular organisations, but rather as a network of distributed competence and specialisation. While initially established by the Department of Science and Innovation (DSI), to close the gaps along the innovation and technology development value chain, and to provide support for technology development and systems integration, the model of Digital Skills Centres (DSC) can be adapted to focus on digital skills development across the wide range of requirements for future productive human capacity. DSCs are conceptualised here as collaborative entities, led by industry, in association with stakeholders from the PSET system and science performing institutions. The DSC approach should be applied to the ***development of digital skills development niches in (1) digital arts, entrepreneurship and innovation; (2) data science, analytics, and machine learning; (3) IoT, cloud and network engineering; and (4) materials science and additive manufacturing***. Much progress has been made in the establishment of an additive manufacturing DSC, to the extent that key proposals for the design, development and implementation of curricula have already emerged (Alabi et al., 2019).

The establishment of Digital Skills Centres will require ***establishment of a range of partnerships***, led by industry associations and professional bodies. These partnerships must ensure the provision of physical and virtual platforms for collaboration and skills development in these identified skills niches. Opportunities for participation by vendors who offer vendor-accredited programmes, together with digital skills providers and PSET institutions in the skills ecosystem, should be emphasised, considering the growing importance of vendor-certified professionals. Moreover, the participation of science performing institutions must strengthen the research and innovation dimensions to skills development.

There is a need for the ***development of new and re-alignment of existing qualifications*** in a range of fields to ensure responsiveness to demands in the digital economy. This process has commenced under the leadership of the MICT-SETA, with a focus on selected qualifications or part-qualifications.

Workplace 4.0 Implementation Measure 2: Steering Investment and Opportunities Towards Digital Skills Development

The funding instruments of the National Skills Fund (NSF), including the skills levy, must be used strategically to ***steer investment towards digital skills development opportunities*** in digital arts, entrepreneurship and innovation; data science, analytics, AI and machine learning; IoT, cloud and network engineering; and materials science and additive manufacturing. The range of instruments include bursaries, learnerships, internships and skills programmes. The National Skills Authority (NSA) should develop guidelines on the mechanisms for prioritising digital skills in skills planning, and deployment of skills funding to SETAs for the purpose of building digital skills.

NSF funding should be invested in the ***start-up of a TVET Teaching Chair programme*** as a catalytic programme and part of the broader revitalisation of the TVET sector. Establishing

teaching chairs in TVETs is aimed at attracting highly qualified and well-recognised academics in their field to selected colleges, to build new or strengthen existing teaching and pedagogical competencies in the delivery of digital skills-oriented qualifications. Teaching Chairs will be expected to build digital skills competencies and specialisations in selected TVET colleges, by drawing on their networks in academia and industry, to promote cooperation and networking that can enhance the institutional capacity of the college. Furthermore, the Teaching Chairs will serve as a critical interface between the academic and professional environments; training and research for sustained research-informed training; and where appropriate, build international links to attract expertise and other resources.

Workplace 4.0 Implementation Measure 3: Expanding Workplace-Based Learning Opportunities and Cyber Awareness

Workplace-based learning is particularly important in a society with a labour market characterised by mismatches between market demand and supply, often attributed to a lack of work experience, and in which a large proportion of young people are unemployed with less than matric. The opportunities for workplace-based learning have grown in volume and are contributing significantly to greater levels of access to post-school qualifications for black South Africans, but with significant room for improvement in terms of gender representation (Wildschut & Kruss, 2019). The high workplace absorption and retention rates, with respect to those who complete learnerships and apprenticeships, makes a strong case for the *expansion of workplace-based learning opportunities*.

The *design and implementation of an incentive scheme to support workplace-based learning* for digital skills development is required. Such a scheme should focus on minimising the costs of integration and socialisation of the learner into the workplace, and on building the capacity of the firm, or government body, to participate in the process, so that effective support can be provided to the learner. In particular, workplace digital skills initiatives, both in industry and government, must provide the *foundations of cyber awareness, necessary to all those engaged in the world of work*. Cyber awareness training should be an obligatory orientation programme for all current and new employees.

Workplace 4.0 Implementation Measure 4: Optimising the Value of Digital Skills in Government

A combination of initiatives to optimise the value of digital government is proposed, focusing on (1) building the technical skills required to operate, manage and sustain the digitally mediated processes of government and the underlying technological systems and databases; (2) the growth in digital literacy with a particular focus on data management and analytics for frontline service staff; and (3) the advancement of digital leadership skills among public service leaders and managers.

The Public Service Sector Education and Training Authority (PSETA), in collaboration with the National School of Government (NSG) and the Department of Public Service and Administration (DPSA), must initiate and implement a *specialist digital skills programme targeting the building of the technical skills* required to develop trained professionals to manage and operate the digital infrastructure, systems and databases, as well as to effectively manage the cybersecurity, underpinning public service digitalisation. The range of professional skills and positions targeted should include (but is not limited to) enterprise

architects, solutions architects, business systems specialists, systems integration specialists, network analysts and engineers, cybersecurity analysts and specialists, data analysts and managers, data centre operations managers, software applications developers, and device support engineers. PSET institutions that provide qualifications and skills programmes for the development of these skills, together with vendors with accredited programmes, should be enlisted as partners in the implementation of this intervention.

The design and implementation of a ***digital literacy programme for frontline public servants, with emphasis on data management and basic data analytics for everyday use***, at sites providing social security (for example, SASSA service and pay points), policing, transport (for example, drivers' licence and testing centres), municipal, health (for example, primary health care facilities), education, and civic services (for example, Home Affairs offices) is required. The NSG, in collaboration with the PSETA, must take a lead role in the design, development and implementation of such a programme. The programme should incorporate general modules on public service digitalisation; digital service delivery; the citizen as user of digital public services; cyber risks including privacy, data protection and cybersecurity; and specialisations focusing on data analytics and management.

The NSG should lead the ***development and implementation of a digital government programme*** for leaders and managers in government to enhance the capabilities of this cohort to steer the transition to digital government. Such a programme should cover a broad range of knowledge components cutting across the macro-, meso- and micro- levels, including building their understanding of the underlying disruptions and changes shaping the emergence of digital society, economy and government; the role of public institutions and strategies to inform digital transformation; and approaches and methods for enabling public service transformation through digital means.

Table 3: Industry 4.0 and Government 4.0 Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To grow the supply of workplace-focused digital skills	• Narrowed digital skills gap in the labour market, particularly for women and persons with disabilities
Measures	**Outputs**
• Develop industry-led digital skills niches and competence	• 3 multi-stakeholder Digital Skills Centres of competence operationalised • Increased the number of workplace graduates from skills programmes in digital skills niche areas
• Steer increased investment and opportunities towards digital skills development	• Increased registration in digital skills-oriented learning programmes • Certification in digital skills development opportunities increased by 30% • 5 or more TVET Teaching Chairs established
• Expand workplace-based learning opportunities in digital skills development	• Incentive scheme to incentivise workplace-based learning opportunities in digital skills building established • Increased number of firms participating in incentive scheme • Number of workplace-based opportunities (learnerships, apprenticeships and internships) for digital skills development accessed • Introduce wide-scale cyber awareness orientation and training to maximise knowledge of cyber vulnerabilities
• Optimise the value of digital skills in government	• 3 specialist digital skills development programmes implemented (data centres operations, analytics and management; network engineering including IoT and

	cloud; software development, engineering, and system solutions architecture)
	• Frontline service delivery data analytics skills development programme implemented
	• Digital government programme implemented for government leaders and managers

7. Strategy Element 4: Digital Skills for Society 4.0

Society 4.0 Challenge and Status

The PC4IR entreats the country to adopt an approach to the development of a digital society as a citizens' initiative that is rooted in communication among sectors of society that enables wide-spread awareness and participation (RSA, 2020a). However, South Africa performs poorly by most international benchmarks that measure digital development, especially on the demand-side indices that measure Internet usage, skills and digital awareness (NPC, 2020). There is a need to close the digital divide between those who passively consume a limited number of basic communication and media services and the limited number able to put digital technology to productive use (NPC, 2020). This needs to be done in a context in which the proportion of households with access to an Internet connection has increased from 23,9% in 2009 to 62,2% in 2017, marked by significant inequality in access (StatsSA, 2019), reflecting the structural inequalities related to income, gender, and geography (NPC, 2020).

One of the underlying factors contributing to the limited access and use of the Internet in South Africa is the high cost of data (Competition Commission, 2019). It is widely recognised that a lack of digital literacy, that is the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and appropriately through digital technologies for employment, decent jobs and entrepreneurship (UNESCO-UIS, 2018), combined with access and affordability contributes to digital exclusion. The lack of digital literacy and access to infrastructure undermines the potential for digital citizenship, that is the regular and flexible access to the Internet, the skills to apply this technology, and regular use of the Internet for participation and functioning in all spheres of the society (Oyedemi, 2018). Furthermore, responsible digital citizenship cannot be exercised outside of safe cyber environments and the skills necessary to secure citizen personal data and privacy.

The *Digital and Future Skills Strategy for South Africa* recognises the challenge of the digital skills divide with many disadvantaged by race, gender, geographic location, income, or disability, or a combination of these, highlighting the need to equip individuals and communities with digital skills, to empower them as citizens for effective participation in the 21st century society. This implementation programme must foster broad-based digital literacy, empowering citizens to effectively participate in digital society, while limiting risk, privacy intrusions and cyber-crime.

Society 4.0: Measures, Activities and Outputs

There must be ***strong emphasis on building digital literacy, digital citizenship and digital health literacy among women and girls, among persons with disabilities, and among other marginalised groups in society***, as necessary to address this particular aspect of the digital divide, with funding identified and made available for this purpose. A few countries are moving to society 5.0, focused on human-centred digital innovation. This is the appropriate route for South Africa to follow, to address its disparities and inequalities. Cyber awareness training and knowledge building must be a major content area in programmes for digital literacy, programmes to advance digital citizenship, and programmes promoting digital health literacy.

DIGITAL SKILLS FOR SOCIETY 4.0
What measures must we implement?

SOCIETY 4.0: TRANSITION FROMSOCIETY 2.0 (MOBILE VOICE COMMUNICATION) TO SOCIETY 4.0(SOCIAL MEDIA + APPS + OTHER) AND LAYING THE FOUNDATIONS FOR SOCIETY 5.0 (HUMAN-CENTRED CONVERGENCE OF CYBERSPACE AND PHYSICAL SPACE TO ADVANCE HEALTH, EDUCATION AND SOCIAL WELL-BEING)

1
DIGITAL LITERACY FOR CITIZENS

2
DIGITAL CITIZENSHIP

3
DIGITAL HEALTH LITERACY OF CITIZENS

Citizens digital literacy programme

20 000 trainers trained

2 million citizens trained in digital literacy

Mass-based digital citizenship programme

Community development worker training of trainers

1 000 000 citizens trained in digital citizenship

10 000 Community Development Workers trained

Awareness and training programme

Community health work training of trainers

5 000 Community Health Workers trained

500 000 citizens trained in digital health literacy

ACTIVITIES AND OUTPUTS

STAKEHOLDERS INVOLVED IN THE MEASURE:

● DSAC   ● DCDT   ● DPSA   ● DoH

Society 4.0 Implementation Measure 1: Building Digital Literacy for Citizens

Access to the Internet and digital technologies alone do not guarantee productive use of these technologies by citizens, although it is a precondition for such use. Citizens must have the ability access, manage, integrate, communicate, evaluate and create information safely and appropriately for productive ends (UNESCO-UIS, 2018).

Developing the digital literacy of citizens must incorporate *the rollout of a large-scale digital literacy programme including content on cyber awareness and cyber secure conduct*, targeting several million citizens in communities where they live, with customised content to ensure that it appropriately targets different citizen segments, including children, young people and the elderly. The focus of the programme has to be on building digital competence in information, media and data literacy, communication and collaboration, digital content creation, safety, devices and software operations, problem solving, and career/work/ entrepreneurship-related information and knowledge. Public libraries, together with other social and community infrastructure, should be at the centre of such a programme, given its importance as a civic space to provide information and knowledge and promote civic participation. The National Library South Africa (NLSA) is in the process of transitioning the Mzansi Libraries On-Line Project (MLO) into the NLSA's Programme offerings, with a special emphasis on rural communities bridging the digital divide (NLSA, 2020). A recent study estimated that 97% of the 1,612 (updated statistics indicate there are now 1,879) public libraries have access to the Internet, but bandwidth limitations remain a challenge (Ledwaba et al., 2020). Public libraries and universities should offer *digital skills courses to support independent living for persons with disabilities*, including device and software use, special cybersecurity needs, accessible banking for financial independence, courses which can lead to micro-credentialling.

The Department of Communications and Digital Technologies (DCDT) leads the digital literacy for citizens' component of the implementation programme, in close collaboration with the frontline service delivery departments, the Local Government Sector Education and Training Authority (LGSETA) and civil society organisations. The rollout of the digital literacy programme targeting citizens must have, as an integral component, a *train-the-trainers programme* in which librarians, para-professionals and community members are trained, in order to build the local capabilities to deliver digital literacy in communities, at this scale. The MLO project has already provided librarians with core ICT competency training, including the use of computing and mobile devices, email, social networking technologies, Internet, digital wellness, and public access to technology. The train-the-trainers programme should be led by the NLSA under the stewardship of the Department of Sports, Arts and Culture (DSAC) and the Provincial Departments of Arts and Culture, in collaboration with provincial departments and the Library and Information Association of South Africa (LIASA).

Society 4.0 Implementation Measure 2: Enabling Digital Citizenship

Digital technologies increasingly mediate the ability of citizens to participate in society. Digital citizenship, that is the ability to enact your role as citizen in society and observe the attendant rights and responsibilities, requires the necessary skills to source social, political, cultural and economic information, and to create different forms of content using multimedia formats.

Developing these skills requires the ***rollout of a mass-based digital citizenship programme*** across the country. The programme curriculum should focus on the development of a range of skills that enable citizens to effectively and productively participate in society: including in media and information literacy and production, in exercising civic rights and responsibilities, in personal and family health literacy, and in balanced use, privacy and security, and consumer awareness. The implementation approach should ***incorporate a train-the-trainer programme targeting Community Development Workers (CDW)*** who should play a pivotal role in rolling out the programme.

The Department of Public Service and Administration (DPSA) should lead the initiative in collaboration with DCDT, the Department of Home Affairs (DHA), Department of Cooperative Governance and Traditional Affairs (COGTA), the Information Regulator South Africa (IRSA) and the National Consumer Commission (NCC).

Society 4.0 Implementation Measure 3: Develop the Digital Health Literacy of Citizens

One of the underlying aims of the *The National Digital Health Strategy for South Africa 2019 – 2024* (DoH, 2019) is to empower all citizens to better navigate their personal health journeys, using digital technologies. This involves the development of digital health literacy of the South African citizenry. Digital health literacy is premised on the ability of citizens to search, acquire, understand, evaluate, communicate and apply health information, and knowledge gained from digital sources, towards citizen health and wellbeing.

A ***national digital health literacy awareness and training programme*** must promote the digital health literacy of the South African citizenry. The programme should be aimed at building the necessary skills among the various demographic segments of South African society, enabling citizens to navigate their own personal health journeys, to access, understand, appraise and apply health information and knowledge gathered electronically. A ***train-the-trainer programme targeting Community Healthcare Workers (CHW)*** must form a pivotal component of the implementation of the programme. This initiative should be led by the Department of Health (DoH) in collaboration with Provincial Health Departments and the Health and Welfare Sector Education and Training Authority (HWSETA).

Table 4: Society 4.0 Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To development the digital literacy of the South African citizenry for enhanced citizen participation and health	• Increased productive use of digital technologies by citizens, with significant attention to women and girls, and persons with disabilities
Measures	**Outputs**
• Promote digital literacy among South African citizens	• Digital literacy programme for citizens, with attention to cyber awareness and cyber security, implemented • 20 000 trainers trained in train-the-trainer programme • 2 million citizens trained in digital literacy
• Strengthen digital citizenship of the South African citizenry	• Digital citizenship programme for citizens implemented • 10 000 Community Development Workers trained in train-the-trainer programme • 1 million citizens trained in digital citizenship
• Enhance the digital health literacy of South African citizens	• Digital health literacy programme for citizens implemented • 5 000 Community Health Workers trained in train-the-trainer programme • 500 000 citizens trained in digital health literacy

8. Strategy Element 4: Society 4.0: Special Focus on Young People Not-in-Employment-Education-or-Training

Young People NEET: Challenge and Status

The lives of young people in South Africa are impacted by multidimensional forms of deprivation, including income poverty, low educational outcomes, poor physical and mental health, and a lack of access to diverse and productive social networks (Graham et al., 2019). Furthermore, young people experience long periods of unemployment that have profound negative impact on their physical and mental well-being (De Lannoy et al., 2018). According to Statistics South Africa (2020) there were 20,4 million young people aged 15-34 years, with about 8,5 million (41,7%) not-in-employment-education-or-training (NEET). Youth unemployment is considered a national crisis that demands urgent, innovative and coordinated solutions (Dicks, 2020). Young people unable to find labour market or further education and training opportunities become invisible to the existing administrative systems (Graham et al., 2019). As such, NEETs fall outside the institutional environments and networks that can be used as points of entry into the labour market.

Important efforts to address the youth unemployment crisis include the establishment of a National Pathway Management Network (NPMN), with the aim to grow a national network reaching three million young people through multiple channels, as part of the Presidential Youth Employment Intervention (PYEI). There are also ongoing efforts to mobilise a basic package of support (BPS) to young people, driven by a range of stakeholders, including the Southern Africa Labour and Development Research Unit (SALDRU) at the University of Cape Town, the Centre for Social Development in Africa at the University of Johannesburg, the DG Murray Trust, and The Jobs Fund, with funding and technical support from the Capacity Building Programme for Employment Promotion, funded by the European Union, and based in the Government Technical Advisory Centre. The rapid rollout of digital platforms such as the Youth Employment Service (YES, www.yes4youth.co.za) and Harambee Youth Employment Accelerator (https://sayouth.datafree.co) are important resources for linking young people and employment opportunities.

Young People NEET: Measures, Activities and Outputs

Addressing the youth unemployment crisis must involve providing meaningful support to young people at risk of becoming stuck along the transition to the labour market, unable to access decent work opportunities, including self-employment opportunities (National Planning Commission, 2019). The International Labour Organisation (ILO, 1999) and its campaign partner organisations, the International Telecommunication Union (ITU) and the United Nations Development Programme (UNDP), consider decent work to encompass opportunities for work that is productive and delivers a fair income, in conditions of freedom, equity, security and human dignity. Addressing youth unemployment must incorporate a process of unlocking learning and digital skills building opportunities, and engaging young people in addressing pressing societal problems. The ITU digital skills toolkit (ITU, 2018) is relevant to these measures, activities and outputs.

SOCIETY 4.0: SPECIAL FOCUS ON YOUNG NEETS
What measures must we implement?

YOUNG PEOPLE NOT IN EMPLOYMENT, EDUCATION AND TRAINING ACCESS DIGITAL SKILLS DEVELOPMENT AND LABOUR MARKET OPPORTUNITIES

1
UNLOCKING LEARNING AND DIGITAL SKILLS BUILDING

2
ADDRESSING SOCIETAL CHALLENGES

YNEET TECH HUB

ACTIVITIES AND OUTPUTS

Digital literacy programme linked to learning and employment

Entry level digital skills programme

Young people training of trainers strategy

Public infrastructure for delivery

Micro-credentialing and digital badging

5 000
young people trained through train-the-trainer programme

2,5 million
young people trained in digital literacy programme

4
pre-entry levels digital skills development programmes

80 000
young people trained in entry level digital skills development

1 000
public and community-based facilities accessed to deliver skills development programmes

Digital literacy in public employment and youth services programmes

Digital rewards programme

500 000
young people participating in public employment and youth service programmes

1 000
corporates participating in digital rewards programme for public and community service

R100 million
mobilised in sponsorship for digital rewards programme

R1 million
young NEETs registered for participation in the digital rewards programme

500 000
young people established a digital skills and asset portfolio

STAKEHOLDERS INVOLVED IN THE MEASURE:

- DWYPD
- NYDA
- PSETA
- Public sector

Young People NEET Implementation Measure 1: Unlocking Learning and Digital Skills Building Opportunities

This measure involves the ***design, development and implementation of a digital literacy programme specifically focusing on sourcing and taking advantage of learning and employment opportunities*** by digital means. The programme should be focused on developing the skills necessary to identify, evaluate and exploit further education and training opportunities across the entire spectrum of the PSET system, such as skills programmes, vendor-specific courses, and practice-oriented short courses; bursaries and funding opportunities; career guidance and leadership development opportunities; and general skills for conducting web research, online communication and collaboration. Furthermore, it should develop the abilities of young people to conduct online market research, undertake strategic planning and business analysis, access and use of financing and crowdfunding platforms, online marketing and networking, and basic business management. The network of co-labs and other digital innovation spaces should form an integral part of the delivery infrastructure for rolling out the digital literacy programme. The digital literacy programme should be complemented by the implementation of an ***entry level digital skills programme for developing data analytics, network engineering and digital design for additive manufacturing skills***. Mixed, augmented and extended reality approaches would be ideal for creating the "virtual experience" as a substitute for the "real experience".

This foundational digital skills programme should provide a pathway towards intermediate and advanced digital skills in these respective domains. The implementation approach to these programmes must incorporate a ***large-scale train-the-trainer strategy in which young people are recruited and accredited*** to deliver the training programmes. It is also important for the training to be delivered in local communities. ***Public infrastructure in metros, districts and local municipalities must be identified for use in the delivery of the training programmes***, including public libraries, Thusong Service Centres, municipal facilities, and schools, must be identified so that training can take place as close as possible to local communities.

The Department of Women, Youth and Persons with disabilities (DWYPD) and the National Youth Development Agency (NYDA) must lead the implementation of the digital literacy and skills programmes, in collaboration with the Presidency, DCDT, Department of Employment and Labour (DEL), Department of Higher Education and Training (DHET), National Electronic Media Institute of South Africa (NEMISA), and the South African Youth Council (SAYC).

A system of ***micro-credentialing and digital badging must be developed that enables certification of short courses***. Certification remains an important source of reliable information to employers, about the training young people have received. A system of micro-credentialing and digital badging facilitates the identification and tracking of the skills, knowledge and competence acquired by young people and enables them to build digital learning portfolios. Digital badging has the potential to provide visible recognition of a learner's achievement (Ellis et al., 2016). Such a system should not be too onerous or bureaucratic. Rather, it should be flexible enough to allow for innovation and adaptation of training courses to be responsive to continuously changing needs in the labour market. It

should, however, be rigorous enough to protect young people from exploitation by unscrupulous training providers (De Lannoy, 2018). The South African Qualifications Authority (SAQA), in collaboration with the Council of the Quality Council for Trades and Occupations (QCTO) and the National Skills Authority (NSA), should lead the design and development of the system of micro-credentialing and digital badging.

Young People NEET Implementation Measure 2: Building Digital Skills Through Addressing Societal Challenges

Local communities in South Africa face a broad range of challenges ranging from delivery of social services such as early childhood development, home-based care, distribution of food parcels and nutritional resources, crime prevention, health and wellbeing support, to environmental services such as waste management, land-based livelihoods support, and parks and beautification services. Young people can contribute to the delivery of these social and environmental services in their local communities, in support of existing and new government and civil society programmes. Existing public employment such as the Expanded Public Works Programme (EPWP) and the Community Works Programme (CWP) and youth service programmes such as the National Youth Service (NYS) and the National Rural Youth Service Corps (NARYSEC) are geared towards addressing these challenges.

Public employment and youth service programmes have a skills development component as part of their design. The *integration of digital literacy into the skills development components of public employment and youth service programmes* is required to equip young people with the necessary digital skills to mobilise and enhance their meaningful participation in South Africa. These programmes reach in excess of 1 million people on an annual basis, of which the youth constitute the majority of programme participants, (NPC, 2017). The skills development component of these programmes should be revised with a view to incorporating digital literacy in the curricula of these programmes. The Department of Public Works, in collaboration with the Department of Rural Development and Land Reform (DRLR), the National Youth Development Agency (NYDA) and the Sector Education and Training Authorities (SETAs) should play a leading role in integrating digital literacy into the curricula of public employment and youth service programmes.

Coding camps for blind persons and persons with other disabilities can be organised by government (Department of Social Development) in collaboration with the private sector and the national and sectoral organisations for persons with disabilities.

The *design and development of a digital rewards programme recognising the skills building*, underpinning the completion of selected public and community service activities by young people, is required to incentivise their participation in these activities. The digital rewards should incorporate both (1) recognition of skills developed resulting from the public and community service activities that contribute to the development of a young person's digital skills portfolio, as well as (2) sponsorship in the form of digital vouchers that enable young people to build up a digital skills and asset portfolio, that can be converted into cash, or tendered for purchasing of selected products and services offered by participating corporates in South Africa. This intervention will need to enlist the participation and sponsorship by corporate South Africa and operate on a digital platform.

Table 5: Digital Skills Development for Young People NEET: Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To facilitate digital skills development training and labour market opportunities for young people not in employment, education and training	• Increased access to education, training and labour market opportunities by young people NEET, with particular focus on young women and young persons with disabilities
Measures	**Outputs**
• Unlock digital learning and skills building opportunities	• Digital literacy programme focused on learning and employment opportunities (including self-employment) implemented • 5 000 young people trained through train-the-trainer programme to deliver digital literacy programme • 2,5 million young people trained in digital literacy programme focused on learning and employment opportunities • 3 pre-entry levels digital skills development programmes developed • 5 000 young people trained through train-the-trainer to delivery entry level digital skills programmes • 80 000 young people trained in entry level digital skills development programme • 1 000 public and community-based facilities accessed to deliver skills development programmes • National framework for recognition of micro-credentialing and digital badging implemented
• Facilitate access to digital skills building opportunities in public employment programmes, and youth and community service	• Digital literacy integrated into the training component of public employment and youth service programmes • 500 000 young people participating in public employment and youth service programmes completed training with a digital literacy component • 1 000 corporates participating in digital rewards programme for public and community service by young people not in employment, education and training • R100 million mobilised in sponsorship for digital rewards programme • 1 million young people not-in-employment-education-or-training registered for participation in the digital rewards programme • 500 000 young people established a digital skills and asset portfolio

9. Cross-cutting Strategy Elements 5 through 8: Leadership, Knowledge and Resourcing

This section combines the four cross-cutting strategy elements.

Leadership, Knowledge and Resourcing: Challenge and Status

The *National Digital and Future Skills Strategy* for South Africa recognises the importance of leadership and governance to ensure successful digital skills generation and development over the next five years, to ensure future impact. It should further be noted that the implementation of this programme will take place in an environment of extreme uncertainty, with an economy that was expected to contract by 7,8% in 2020, thus, requiring a fiscal consolidation pathway over the next five years (National Treasury, 2020). The diagnostic report of the PC4IR acknowledges that the skills development ecosystem is characterised by a silo mentality and expresses concerns about the speed at which entities are able to adapt

and change curricula, understand the needs of the workplace and provide accredited solutions to meet these needs (RSA, 2020a). Implementation is often hindered by coordination failures resulting from split accountability and overlapping mandates (National Planning Commission, 2011).

Leadership, Knowledge and Resourcing: Measures, Activities, Outputs

A radical shift in the human resource ecosystem, including a re-think of the architecture of the skills ecosystem, acceleration of the upskilling of young people, and the re-skilling of the existing workforce is required, given the above-mentioned conditions facing the country. The digital skills development programme should be regarded as a set of initiatives led and regulated by the state that introduces changes that are catalytic, to ensure flexibility, integration of learning streams, mobility of learners, and the use of technology to ensure the efficiency of the skills delivery system. The implementation programme therefore incorporates a set of interventions to enable distributed leadership and governance of the programme, build our knowledge of the digital ecosystem, and effectively resource the implementation of the programme under adverse fiscal conditions, as set out below.

Figure 3: Digital leadership

DIGITAL LEADERSHIP

LEADERSHIP SKILLS THAT ENABLE PEOPLE TO EFFECTIVELY MANAGE AND LEAD ORGANISATIONS IN THE DIGITAL ERA, WITH DUE KNOWLEDGE OF AND ATTENTION TO CYBERSECURITY, UNDERSTANDING THAT STRATEGIC LEADERSHIP IS CRITICAL FOR EFFECTIVE DIGITAL TRANSFORMATION OF ORGANISATIONS, ECONOMIES AND SOCIETIES

Source: Abrahams, 2021

The implementation challenges, which include the need to constantly adapt to a changing digital environment and a changing economic environment, means that strategic leadership is synonymous with adaptive digital leadership. The measures, activities and outputs set out in the various sections of this document need to be interpreted in the real-world context of South Africa, with leaders and their organisations finding creative ways to make digital skills building a priority, as this is the foundation of the future economy. Collaborative digital leadership is the key to success, with attention to the challenges of the digital divide, for young people, for women and girls and for persons with disabilities.

Leadership, Knowledge and Resourcing Implementation Measure 1: Institutionalising Distributed Programme Implementation Leadership and Governance

The complexity of the skills development ecosystem calls for an implementation approach that goes beyond the limitations of bureaucratic forms of organisation, still the dominant mode of organisation in the public sector. Whereas bureaucratic forms of organisation emphasise centralisation, authority and control, the network mode of organisation places emphasis on a plurality of actors, interdependence, and incentives for collective action (Kickert et al., 1999). Distributed leadership and governance structures, premised on the recognition that no one actor or entity has all the knowledge, expertise and resources to enable digital skills development for the country, are *characteristics of the network mode of organisation, more suited to addressing the complex challenges of the ecosystem*.

The proposed institutional arrangements to give effect to distributed leadership and governance further draw on the underlying features of *contemporary platform modes of social and economic organisation*. In a platform environment, the platform architecture establishes the design and development rules, provides for shared governance through decision-rights partitioning, and assures the autonomy of organisations, within the constraints of the platform rule. Structurally, the platform can accommodate large numbers of partners and collaborators, with the locus of control distributed among collaborating organisations. The style of management in platform environments is oriented towards innovation, and takes place by orchestration, rather than by giving and carrying out instructions. Managerial responsibility involves a careful balancing act between the ecosystem collaborators' autonomy and ecosystem-wide integration. Coordination mechanisms include norms and values (relational), rewards and sanctions (metrics), prescribed methods and procedures (process), and criteria for participation (authorising) (Tiwana, 2014).

The institutional arrangements proposed in this implementation programme draw on the ethos of network and platform modes of organisation. In this context, a Digital Skills Forum (DSF) must be established to lead, oversee and coordinate the implementation of the national digital skills programme. The gender equity, persons with disabilities and YNEET sectors should be well represented in this forum. A critical function of the DSF is to provide strategic direction to the implementation of the programme, prioritise and coordinate areas of focus, mobilise resources in the form of expertise, funding and institutional support, and monitor performance. The DSF will also advise on the re-conceptualisation and structuring of the skills development ecosystem, in support of digital skills building. The DSF should link into the Human Resource Development Council (HRDC) as a chamber, given its advisory role on human resource development of the country, so that the necessary alignments between digital skills building and the broader skills environment can be facilitated.

In utilising existing structures as far as possible, the 4IR Project Management Office in the DCDT will perform a pivotal management and coordination role. This role will include leading, planning, organising, communication and advocacy, as well as resource mobilisation, performance monitoring and reporting functions, supported by the relevant directorates in the DCDT. This will involve the setting up of the necessary management and administrative processes and systems to manage the collaborative implementation of the programme, coordinate the work of partners and collaborators, identify and mitigate risks,

build networks and disseminate information about the activities being implemented as part of the programme.

The ***cluster of interventions aimed at strengthening digital foundations*** will be led by the Department of Basic Education (DBE) in close collaboration with the Provincial Departments of Education, the South African Council for Educators (SACE), the National Education Collaboration Trust (NECT), and education labour unions. In this cluster, the DHET will play an important role in regard to actions and investments aimed at building the digital competence of educators, together with HEI faculties and schools of education, the ETDPSETA, DBE circuit managers, subject advisors and related school ICT structures.

A few key institutional innovations are proposed to drive and embed digital pedagogical capabilities, in strengthening the foundations for digital skills. A university consortium must be established, specializing in digital pedagogy innovations for teacher and subject advisor development. Furthermore, innovation in the design of schools and classrooms as centres of both face-to-face and virtual learning, fostering collaboration with public community centres, libraries and Thusong Service Centres, is required. Furthermore, collaborative public-private and public-public business models such as the DBE Cloud, the Sentech Learn educational content streaming platform, and Vodacom Schools must be encouraged and strengthened.

In the case of the ***cluster of activities aimed at developing intermediate and advanced digital skills***, the DHET will take the overall lead and also lead the implementation of activities related to building a future-ready TVET subsystem, and developing the higher education system as a platform for advanced digital skills, in collaboration with the DBE, Universities South Africa (USAf), the Association of College Principles, HEI Faculties and Schools of Education, ETDPSETA and other SETAs, the Department of Science and Innovation (DSI), Department of Trade, Industry and Competition (DTIC), NEMISA, the National Research Foundation (NRF), science councils, and the Council for Higher Education (CHE). In the case of building a vibrant ecosystem for digital entrepreneurship, the DTIC will play a leading role, together with the Department of Small Business Development (DSBD), the Small Enterprise Development Agency (SEDA), DSI (Technology Transfer Station Programme), and NEMISA.

The institutional innovations to support intermediate and advanced digital skills development must focus on rethinking, reshaping, and redesigning TVETs, as is being done in all major innovation-focused countries. Furthermore, measures must be put in place to strengthen collaboration between universities, TVETs and science performing agencies.

The DTIC and the DPSA will provide overall leadership for the ***cluster of activities related to, workplace readiness in the private sector and government***. Activities directed at building digital skills for the private sector will be undertaken in collaboration with the DHET, through the National Skills Authority (NSA) Secretariat, SETAs, science councils and innovation spaces, universities and TVETs. Activities targeting the optimisation of skills for digital government will be led by the DPSA, through the National School of Government (NSG), in collaboration with the Government Information Technology Officers Council (GITOC), the State Information Technology Agency (SITA), Broadband Infraco (BBI), Sentech, the South African Local Government Association (SALGA), the Public Services Sector Education and Training Authority (PSETA), and frontline public service departments.

The institutional innovations should be directed at ensuring that the NEDLAC, NSF and SETA agendas, together with the relevant government entities and workplace forums, focus more strongly on digital skills development. It is also necessary to strengthen the helix of university-TVET-industry linkages and relations. A digital innovation expert centre, established as a capability to advise public sector institutions with a range of digital transformation initiatives, must be considered as an important institutional innovation to support the evolution of digital government in South Africa.

The overall leadership for the ***cluster of activities enabling digital skills development for Society 4.0*** will be provided by the Department of Social Development (DSD), in close collaboration with Department of Home Affairs (DoHA), Department of Cooperative Governance and Traditional Affairs (COGTA), Department of Sports, Arts and Culture (DSAC), Department of Health (DoH), and other front line service delivery departments, LGSETA, the Services SETA, HWSETA, the Centre for Public Service Innovation (CPSI), National Library South Africa (NLSA), and the Information Regulator South Africa (IRSA) and the National Consumer Commission (NCC).

The Department of Women, Youth and Persons with disabilities (DWYPD), through the National Youth Development Agency (NYDA), should lead the implementation of the ***cluster of activities targeting young people not-in-employment-education-or-training*** (NEET). A broad range of collaborators are required for the effective implementation of this cluster of interventions, including the Project Management Office in the Presidency, the Government Technical Advisory Centre (GTAC), DHET, the Department of Employment and Labour (DEL, Employment Services of South Africa), the NSA, SETAs, NEMISA, and programmes such as the Youth Employment Service (YES) and the Harambee Youth Employment Accelerator. Stakeholders involved in mobilising support for the Basic Package of Support for young people are also critical.

A key institutional innovation targeting NEETs is **the establishment of a data-driven 'platform of platforms'**, see Figure 4 below, that links and enables data-sharing across a number of existing databases and information systems within the skills development ecosystem, that are crucial for defining and profiling the needs of young people and making the rollout of the National Pathway Management Network (NPMN) a reality.

Figure 4: Institutional Design of the Digital Skills Development Programme Implementation Platform
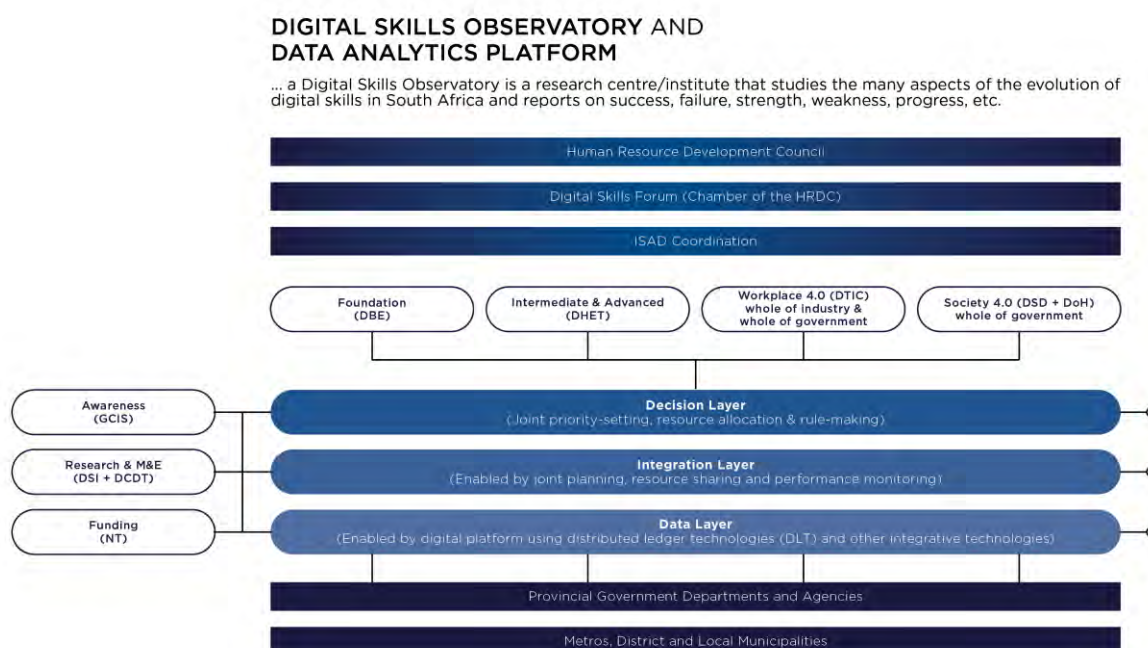
Source: Burke, 2021

There are clusters of activities that are cross-cutting and are required to support the implementation programme. The interventions to **create awareness** will be led by the Government Communication and Information Services (GCIS), while **research, performance monitoring and evaluation** will be led by the DCDT, and the **resource mobilisation and funding** will be led by the National Treasury (NT). The leadership and management architecture must effectively incorporate provincial and local government stakeholders, given their role in the programme's implementation locally.

The platform design provides for three layers, that is the data, integration and decision layers. The **data layer** is critical to the success of the implementation programme, given the critical role information will play in mapping digital skills demand and supply, and in facilitating access to services and support in the rollout of these services. A number of disparate databases and management information systems exist that do not have standardised frameworks for interoperability and sharing of data. For example, keeping track of developments and dynamics in the basic education sector requires data from various sources, such as the Education Management Information System (EMIS), the Learner Unit Record Information and Tracking System (LURITS), the South African School Administration and Management System (SA-SAMS), Provincial Data Warehouses, information systems

developed for the Data-Driven Districts Initiative, and the National Senior Certificate Database. In the PSET environment, databases and information systems include the Higher Education Management Information System (HEMIS), TVET MIS, Sector Education and Training (SET) MIS, NSFAS Database, the National Artisan Development (NAD) database management system, and the individual management information systems of 21 SETAs. Furthermore, datasets from the National Youth Service platform and the Youth.mobi platform are important building blocks to create a more comprehensive profile of the skills needs, developments and transitions into the labour market. Automated data-sharing across these databases and information systems is critical to the success of the national digital and future skills implementation programme, using technologies such as distributed ledger technology (DLT), or application programming interfaces (APIs), that enable access to relevant data, in order to build profiles, identify skills development needs, and link people to income opportunities through digital case management.

The *integration layer* is geared towards ensuring an integrated approach to planning, resource sharing and performance monitoring. This will involve joint planning on an annual basis, analysis of resource requirements, ensuring joint resource mobilisation, and integrated performance monitoring. The *decision layer* involves joint priority setting and resource allocation among stakeholders, led by the respective departments responsible for each cluster of interventions as set out above. Furthermore, stakeholders will establish the rules by which the different work-streams will be governed and managed.

Awareness of the digital transitions and their effects in economy and society remains limited in South Africa. A survey by Kagiso Trust (2019) suggest that only 1% of 1 123 respondents surveyed in 20 districts in all provinces regard themselves as highly knowledgeable about the "4IR", while half of those surveyed believe that the 4IR should not be taken seriously. There is an urgent need to launch a *mass awareness campaign* on the critical importance of digital skills, in preparing citizens to effectively participate in the opportunities and in mitigating the risks associated with this major economic transition. Such a campaign should harness youth leadership and civic participation to promote the development of digital skills through a multi-media campaign combining face-to-face, community outreach, social media platforms, and public broadcasting media including radio and television. Recruitment of volunteers trained in communicating key messages through various channels, including schools, sports clubs and activities, and other community outlets, must form a cornerstone of the campaign.

Leadership, Knowledge and Resourcing Implementation Measure 2: Establishing a Digital Skills Observatory

Collecting data and conducting analysis necessary for constructing knowledge about the complexities and dynamics of growing skills for the digital economy remain critical constraints to taking advantage of opportunities for evolution of the South African economy. The development of a more comprehensive account and explanation of transitions and dynamics in the process of digital skills demand and supply necessitates the construction of a knowledge base that integrates perspectives from diverse disciplinary domains and provides a synthesis of the multiple causes and outcomes of digital skills investments. The *establishment of a Digital Skills Observatory* is proposed, to address this gap in knowledge. The proposed research observatory must institutionalise observation capacity

that is able to monitor and study digital skills demand and supply over a sustained period of time, synthesising research outcomes across disciplinary boundaries, drawing on a diverse range of research infrastructures, and actively engaging policy-makers and actors in the skills development ecosystem on the basis of this research and scientific enquiry. The focus of the Digital Skills Observatory must be on bringing together existing data sets and presenting them in accessible, attractive ways to a variety of audiences; facilitating the use of data by agencies and actors whose activities impact the developments in the specific disciplines, sectors or communities; and facilitating co-operation between various local actors and researchers, policy makers, practitioners and community members. An initial *digital skills research framework* is attached as ***Annexure A***. The design and operation of the data-driven platform-of-platforms will be one of the main initiatives of the observatory, hence an initial expression of the design of the platform-of-platforms is included in Annexure A.

The conceptual approach underlying the establishment of the Digital Skills Observatory stresses the importance of shifting away from a situation that is characterised by isolated and disparate patches of research and institutional infrastructure, to an environment in which the research community, research infrastructures and collaborations are knit together to form a coherent and integrative system. Building on the experience of the Labour Market Intelligence Programme (LMIP), the Digital Skills Observatory must serve as a centralised repository for databases and other information resources on digital skills demand and supply in order to monitor and measure trends, evaluate programmatic outcomes, disseminate research outcomes and undertake networking initiatives, as the foundation for consultation, design and implementation.

The annual publication of a ***State of Digital and Future Skills report*** should be a pivotal output of the observatory. Different types of research products, including issues papers (investigating specific issues in detail), concept papers (examining and investigating specific trends and developments), policy briefs (noting the policy implications of specific developments and dynamics), and trends reports (observing and analysing emerging trends), should be produced. The tools, methodologies, networks and expertise established through the LMIP must be taken forward through the Digital Skills Observatory.

Leadership, Knowledge and Resourcing Implementation Measure 3: Resourcing the Digital and Future Skills Implementation Programme

The Government of South Africa has embarked on a fiscal consolidation pathway for the next several years, given the contraction of the economy and the high levels of uncertainty prevailing due to COVID-19 (National Treasury, 2020). The country faces adverse fiscal conditions, driven also by unsustainably high levels of debt. In this context, with many competing social, infrastructure and economic priorities, it is important to recognise that resource mobilisation for digital skills is an integral part of preparing the country for productive participation in the 21st century regional and global economy, rather than an unaffordable indulgence. The approach to mobilising the necessary financial resources to implement the national digital and future skills programme, therefore, consists of a combination of four funding mechanisms and approaches.

Firstly, it is necessary to mobilise new funding for supporting the rollout of the national digital and future skills implementation programme. Doing so requires the ***establishment of the Digital Development Fund (DDF)***, dedicated to mobilising and deploying funding to enable the evolution of digital and future skills. The DCDT is in the process of preparing legislation to dissolve the Universal Access and Service Fund (USAF) and to replace it with the DDF. A process to design, develop, structure and implement the DDF, under the leadership of the National Treasury, must be undertaken in close collaboration with the DCDT. Although this fund will have a broader remit than digital and future skills, the design of the DDF must ensure that a specialised funding instrument within the DDF must be targeted at skills development.

Secondly, a ***focus on digital and future skills development must be integrated and institutionalised more deliberately in existing funding platforms*** such as the National Skills Fund (through the SETAs), the Jobs Fund (through the funding window targeting support for work seekers), and the Labour Activation Programmes (LAP) funded via the Unemployment Insurance Fund (UIF). Resources channelled through these funds should target digital skills development that is oriented towards meeting labour market demands and linking young people to decent jobs.

Thirdly, the ***skills component for infrastructure earmarked grants*** where physical infrastructure includes Internet connectivity and network infrastructure must integrate digital skills development related to the delivery of these projects. This will apply to earmarked grants such as the Education Infrastructure Grant (EIG) for DBE and the Infrastructure and Efficiency Grant (IEG) for the DHET. Fourthly, interventions will be ***funded through the parliamentary budget vote process***, as part of the execution of the mandate of departments, agencies and entities.

Finally, ***funding must be mobilised through international development cooperation and the private sector***. A targeted drive to mobilise funding from the international community, through South Africa's traditional and new partnerships with multilateral agencies and bilateral relations, must be initiated with a view to raising development funding for the digital and future skills priorities outlined in the implementation programme. Furthermore, a funds mobilisation campaign must be initiated to raise private sector funding for this purpose.

Table 6: Leadership, Knowledge and Resourcing: Measures, Outputs and Outcomes

Strategy Goal	Outcomes
• To effectively mobilise leadership, institutional and funding resources for the implementation of the digital and future skills programme	• Institutionalised the provision of digital skills in the education, training and skills development ecosystem
Measures	**Outputs**
• Build a digital and future skills implementation platform	• Established governance and management structures • Enabled secure data-sharing across multiple databases and management information systems (platform of platforms) • Implemented a performance dashboard to track programme implementation • Multimedia digital skills awareness campaign implemented
• Build a knowledge base on digital skills demand and supply	• Digital Skills Observatory established and maintained • Annual State of Digital and Future Skills Report produced • Various knowledge resources and products produced and packaged • Digital skills research community of practice established and maintained
• Mobilise funding to support digital skills development	• Digital Development Fund established • R1 billion mobilised for digital skills development in the DDF • R500 million mobilised through the NSF for digital skills development • R500 million mobilised through the LAP-UIF • R250 million mobilised through the Jobs Fund with an additional R500 million in co-funding • R500 million mobilised through international development and corporate funding

10. Digital Skills Convergence Journey: Implementation Approach for Digital Skills Benefits Realisation

The implementation approach must adopt the principles relevant to benefits realisation (New South Wales Government, 2018), adapted to the South African digital skills context, as follows:

1. A benefit derived from the implementation of the National Digital and Future Skills Strategy is a measurable improvement in digital and 21st century skills which is perceived as an advantage by many South African stakeholders.

2. Benefits must be aligned to the goals of the National Digital and Future Skills Strategy to achieve a digitally-enabled economy and society.

3. Benefits of digital and future skills investment and development need to be first understood as outcomes. Benefits are the reason an investment is made.

4. Benefits of investment in and development of digital and future skills must be measurable and evidence-based in order to demonstrate that an investment provides value.

5. Benefits of digital and future skills can only be realised through continuous change and adaptation, and such change can only be sustained by realising reciprocal benefits.

6. Benefits of digital and future skills advances need to be owned by appropriate sponsors, leaders and managers in government, industry and society.

7. Intermediate benefits are needed to realise end benefits, meaning that milestones are important for achieving successful outcomes from the investment in digital and future skills.

8. Since benefits are dynamic, the specific benefits of investment in and development of digital and future skills need to be regularly reviewed and updated, and the results of the reviews must be made public.

9. Government should keep the number of benefits monitored and reported to a sensible, manageable number, noting that the selected benefits should advance over a multi-year period.

10. Benefits management for digital and future skills should be integrated with other processes relevant to evolution of the digital economy and society.

Outcomes from such a digital benefits realisation process are presented in the digital skills journey diagram below, which represents the convergence of the multiple strategy elements.

Figure 10: Digital skills convergence journey
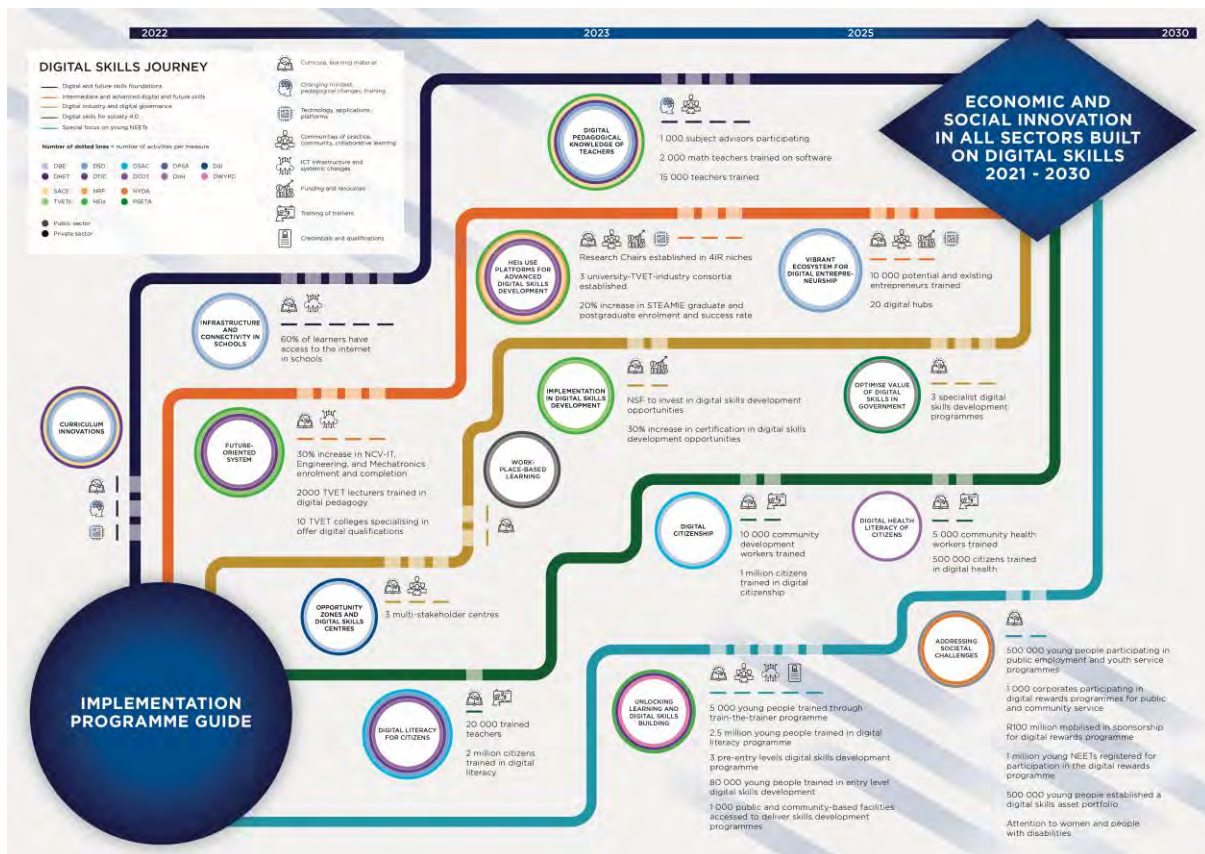
Source: Abrahams, Burke & The Data Innovator, 2020

11. Risks

The table below outlines the key risks to the effective implementation of the programme and appropriate risk mitigation measures.

Table 7: Leadership, Knowledge and Resourcing Goals and Objectives

Outcome	Key Risk	Risk Mitigation	Responsible
Digital Foundations			
• Enhanced the cognitive capabilities of learners in basic education	• Curriculum changes introduced disrupt performance	• Effective change management underpins the interventions introduced	• DBE
• Improved the 21st century skills of learners	• Resistance by educators to implement E^3 methodologies	• Implement awareness programme to obtain educator buy-in	• DBE
• Improved the digital competence of learners completing matric	• Inadequate Internet connectivity facilities and learning resource materials	• Mobilise partnerships to ensure adequate support for the rollout of the relevant curricula and subjects	• DBE
Intermediate and Advanced			
• Increased the number of STEAMIE graduates pursuing advanced digital skills in 21st century niche areas	• Limited funding available to support postgraduate training in advanced digital skills	• Target postgraduate training in advanced digital skills through the NRF postgraduate funding policy	• DHET/ DSI
• Increased the number of graduates completing digital skills-oriented qualifications in the TVET system	• Unable to expand the enrolments in digital skills-oriented qualifications due to a shortage of appropriately qualified lecturers	• Implement lecturer training programme to develop teaching capacity in digital skills-oriented qualifications	• DHET/ HEIs
• Increased digital business start-up and growth	• Poor quality business development services provided	• Implement programme to strengthen the BDS offerings provided in innovation spaces	• DTIC
Workplace 4.0			
• Decreased digital skills gap in in the labour market	• Poor information and knowledge on digital skills needs in the labour market	• Establish a Digital Skills Observatory to study and track the demand and supply of digital skills to the labour market	• DCDT/ DHET
Young People NEET			
• Increased access to education, training and labour market opportunities by Young People NEET	• Poor linkages between the needs of young people and the opportunities available	• Implement digital skills case management that matches the profiles and needs of young people with digital skills training opportunities available	• DWYPD
Society 4.0			
• Improved productive used of digital technologies by citizens	• Unequal access to digital technologies	• Engagements with telcos to improve the scope and quality of coverage and bring down data costs	• DCDT/ DTIC
Leadership, Knowledge and Resourcing			
• Institutionalised the provision of digital skills in the education, training and skills development ecosystem	• Poor buy-in from stakeholders in government and the private sector	• Active Presidential and Ministerial support for the implementation of the digital and future skills building programme	• Presidency

12. Performance Monitoring and Evaluation

The implementation plan sets out clear outputs and deliverables to measure programme implementation performance.

A six-monthly report on progress should be produced by the programme implementation coordination team, analysing performance against the plan. These six-monthly reports should feed into annual reviews. An annual review of performance should be conducted that interrogates whether there are any significant changes in the external and internal environment, and whether and how any of the major assumptions underpinning the programme implementation plan have changed. The annual report should provide a more detailed analysis that reflects on the performance over the year and incorporates a review of the targets achieved.

A mid-term review should be undertaken at the end of the first three-year cycle. This review is an important opportunity to determine which aspects of the planning and design related to the implementation programme require significant changes, and what those changes should be. An in-depth evaluation should be undertaken towards the end of the five-year planning cycle. The evaluation should consider the relevance, effectiveness and efficiency, impact and influence on the sustainability of the digital and future skills implementation programme.

Table 8: Performance Monitoring and Evaluation Cycle

Year / Month	2020/21	2021/22	2022/23	2023/24	2024/25
April	• Implementation plan approved	• Annual work plan approved	• Annual work plan approved	• Revise and approve business plan report	• Annual work plan approved
September	• Prepare mid-year review report	• Prepare mid-year review report	• Prepare mid-year review report	• Prepare mid-year review report	• Conduct independent evaluation
March	• Prepare annual review report	• Prepare annual review report	• Prepare mid-term review report	• Prepare annual review report	• Independent evaluation report

13. Implementation Programme Matrix

Goal	Outcomes	Objectives	Outputs	Baseline	5-Year Target	Annual Target					Key Stakeholders	
						21/22	22/23	23/24	24/25	25/26	Lead	Support
Digital Foundations												
To expand the development of digital competencies in schools for improving the cognitive abilities of learners	Enhanced the cognitive capabilities of learners in basic education	To enable curriculum innovation focusing on digital literacy, coding and robotics, and 21st century skills in basic education	Integrated digital literacy, coding and robotics from Grade 1 – Grade 9 in all public schools	Gr 1 – 3 pilot	Gr 1 – 9	Gr 1 - 3	Gr4 - 6	Gr 7 - 9	All	All	DBE	PDEs, SACE, UNISA
			21st century skills (E³) integrated into the CAPS curriculum	Pilot	9 Provinces	3	6	9	9	9	DBE	CfE, CIDA, NECT, NLF
				73 Schools	73 Schools	120	180	240	300	360	DBE	CfE, CIDA, NECT, NLF
			Educational digital applications integrated into 6 school subjects in secondary school	-	6 Subjects	Pilot	Pilot	2 Subjects	4 Subjects	6 Subjects	DBE	
			Developed a digital literacy curriculum framework for the ECD sector	-	3 000 ECD Centres	Developed	Piloted	200 ECDs	1 000 ECDs	3 000 ECDs	DBE	DSD, DoH
			Digital pedagogy communities of practice established	-	9 Provinces	3	6	9	9	9	DBE	PDEs, SACE
			Increased the number of Grade 12 learners taking one of the computer subjects (CAT or IT) at public school	6% of students enrolled in Matric	15%	6%	8%	10%	12%	15%	DBE	PDEs
		To strengthen the digital pedagogical capabilities of teachers	Teachers trained in terms of the PDFDL	TBC	15 000	1 500	1 500	3 000	3 000	6 000	DBE	PDEs, SACE
			Digital pedagogy integrated as a subject into the teacher education curricula at HEIs	TBC	26 Universities	5	10	15	20	26	DHET	USAf
			Mathematics teachers trained in the application of dynamic software	-	2 000	300	300	300	500	600	DBE	DHET
			Subject advisors participating in community of practice on digital pedagogy	-	1 000 Active Subject Advisors	100	300	600	900	1 000	DBE	PDEs, SACE
			University consortium established specializing in digital pedagogy innovations for teacher and subject advisor development	-	1	Inception	Operation	Operation	Operation	Operation	DHET	USAf
		To promote access to Internet connectivity digital infrastructure, facilities and educational resources	Increased learner access to the Internet in schools	21%	60%	25%	40%	50%	55%	60%	DBE	BBI/ Telecos
			Increased the access be learners to e-LTSM	-	60%	25%	40%	50%	55%	60%	DBE	
Intermediate and Advanced Digital Skills												
To develop intermediate and advanced digital skills through the post-school education and training and innovation ecosystems	Increased the number of graduates completing digital skills-oriented qualifications in the PSET system	To enhance the relevance of the TVET subsystem to the needs of the digital economy and society	Implemented the re-curriculated NCV-IT offered across TVET system	-	Full Implementation	Pilot	Implement	Implement	Implement	Implement	DHET	Association of TVET College Principals, ETDPSETA, HEI Faculties of Education
			Developed robotics, data analytics and coding as specialisations in the NCV-IT	-	Robotics, Data Analytics & Coding Specialisations Implemented	Robotics Implemented	Data Analytics Developed	Data Analytics Implemented	Coding Developed	Coding Implemented	DHET	Association of TVET College Principals, ETDPSETA, HEIs
			Increased the number of students completing NVC (L2 – 4) Engineering and Related Design	1 200	1 800 per annum	1 320	1 380	1 500	1 560	1 800	DHET	Association of TVET College Principals, ETDPSETA, HEIs
			Increased the number of students completing NVC (L2 – 4) IT&CS	450	675 per annum	540	584	630	653	675	DHET	Association of TVET College Principals, ETDPSETA, HEIs
			Increased the number of students completing NVC (L2 – 4) Mechatronics	90	160 per annum	108	117	126	135	170	DHET	Association of TVET College

Outcome	Sub-outcome	Objective	Output / Indicator	Baseline	Target						Lead	Partners
												Principals, ETDPSETA, HEIs
			TVET lecturers trained in digital pedagogy	-	2 000	100	250	400	500	750	DHET	Association of TVET College Principals, ETDPSETA, HEIs
			Increased the number of TVET colleges differentiated by digital qualification specialisations	-	10	2	4	6	8	10	DHET	Association of TVET College Principals, ETDPSETA
			Increased the number of STEAMIE graduates in higher education (Masters and PhD)	4 500	5 500 per annum	4 635	4 820	5 060	5 314	5 580	DHET	DSI
			4 university-TVET-industry consortia established	-	Data science, Analytics, and Machine Learning Consortium Operational	Inception	Operational	Operational	Operational	Operational	TVETs	Industry Associations & Professional Bodies
				-	IoT, Cloud and Network Engineering Consortium Operational	Inception	Operational	Operational	Operational	Operational	TVETs	Industry Associations & Professional Bodies
				-	Materials Science and Additive Manufacturing	Inception	Operational	Operational	Operational	Operational	TVETs	Industry Associations & Professional Bodies
			NRF and Industry Research Chairs established in 21st century digital innovation niche areas	-	5	1	1	1	1	1	DHET	DSI, NRF, USAf
	Increased digital business start-up and growth	To increase access to digital entrepreneurship services to potential and existing entrepreneurs for the digital economy	Supported the rollout of 20 Digital Hubs	TBC	20	2	2	5	5	6	DTIC	SEDA, DSI
			Established an innovation system coordination platform	-	1 Coordination Platform	Inception	Established	Operational	Operational	Operational	DTIC	SEDA, DSI
			Innovation spaces offering digital entrepreneurship skills development programmes	-	50	20	30	40	45	50	DTIC	SEDA, DSI
			Potential and existing entrepreneurs trained in digital entrepreneurship	-	10 000	500	1 000	3 000	3 000	2 500	DTIC	SEDA, DSI
Workplace 4.0												
To grow the supply of workplace-focused digital skills	Narrowed digital skills gap in in the labour market	To develop industry-led digital skills niches and competence	3 multi-stakeholder Centres of Competence operationalised	-	Data science, Analytics, and Machine Learning CoC operationalised	Inception	Operational	Operational	Operational	Operational	Relevant Industry Associations	Relevant Professional Bodies, SETAs, Universities, TVETs
				-	IoT, Cloud and Network Engineering CoC Operationalised	Inception	Operational	Operational	Operational	Operational	Relevant Industry Associations	Relevant Professional Bodies, SETAs, Universities, TVETs
				-	Materials Science and Additive Manufacturing CoC Strengthened	Operational	Operational	Operational	Operational	Operational	Relevant Industry Associations	Relevant Professional Bodies, SETAs, Universities, TVETs
			Increased the number of graduates from digital skills programmes in digital skills niches	TBC	30%	10%	15%	20%	25%	30%	NSA	SETAs, Industry Associations, professional Bodies

		Objective	Indicator/Output	Baseline	Target	Y1	Y2	Y3	Y4	Y5	Lead	Partners
		To steer increased investment and opportunities towards digital skills development	Increased registration in digital skills-oriented skills programmes	TBC	40%	10%	15%	20%	30%	40%	NSA	SETAs, Industry Associations, professional Bodies
			Increased number of learners completing digital skills-oriented skills programmes	TBC	40%	10%	15%	20%	30%	40%	NSA	SETAs, Industry Associations, professional Bodies
			TVET Teaching Chairs established	-	5	1	1	1	1	1	DHET	TVETs
		To expand workplace-based learning opportunities in digital skills development	Incentive scheme to incentivise workplace-based learning opportunities in digital skills development established	-	Incentive Scheme Operationalised	Design & Feasibility	Business Plan	Inception	Operational	Operational	NSF	SETAs
			Increased number of firms participating in incentive scheme	-	9 000	-	-	6 000	7 500	9 000	NSF	SETAs
			Increased the number of workplace-based opportunities (learnerships, apprenticeships and internships) for digital skills development accessed	-	15 000	-	-	9 000	11 250	13 500	NSF	SETAs
		To optimise the value of digital skills in government	Specialist digital skills development programmes implemented	-	3 250 Graduates in Data Centres Operations, Analytics and Management Programme	Curriculum Developed	250 Graduates	500 Graduates	1 000 Graduates	1 500 Graduates	NSG	Universities & Training Providers
				-	3 250 Graduates in Network Engineering including IoT and Cloud Programme	Curriculum Developed	250 Graduates	500 Graduates	1 000 Graduates	1 500 Graduates	NSG	Universities & Training Providers
				-	3 250 Graduates in Software Development, Engineering, and System Solutions Architecture Programme	Curriculum Developed	250 Graduates	500 Graduates	1 000 Graduates	1 500 Graduates	NSG	Universities & Training Providers
			Frontline service delivery data analytics skills development programme implemented	-	10 000 Graduates	Curriculum Developed	1 000	1 500	3 000	4 500	NSG	Universities & Training Providers
			Digital government programme implemented for government leaders and managers	-	1 000 Graduates	Curriculum Developed	50	250	300	400	NSG	Universities & Training Providers
			Digital Innovation Expert (DIE) Centre Established		DIE Centre Operational	Design & Feasibility	Business Plan	Inception	Operational	Operational	DSI	CPSI, DPSA
Society 4.0												
To development the digital literacy of the South African citizenry for enhanced citizen participation and health •	Increased productive use of digital technologies by citizens	To promote digital literacy among South African citizens	Digital literacy programme for citizens implemented	-	2 million Citizens Trained	Curriculum Developed	500 000	500 000	500 000	500 000	DCDT	COGTA, LGSETA, SALGA SANGONeT CPSI, DACS
				-	20 000 Train-the-Trainer Trained	Curriculum Developed	5 000	5 000	5 000	5 000	DCDT	COGTA, LGSETA, SALGA, SANGONeT CPSI, DACS
		To strengthen digital citizenship of the South African citizenry	Digital citizenship programme for citizens implemented	-	1 million Citizens Trained	Curriculum Developed	250 000	250 000	250 000	250 000	DPSA, DCDT	DHA, DJ&CD, COGTA, Information

												Regulator, Services SETA
			-	10 000 Com Dev Workers Trained in Train-the-Trainer	Curriculum Developed	2 500	2 500	2 500	2 500	DPSA, DCDT		NSG, DHA, DJ&CD, COGTA, Information Regulator, Services SETA
	To enhance the digital health literacy of South African citizens	Digital health literacy programme for citizens implemented	-	500 000 Citizens Trained	Curriculum Developed	125 000	125 000	125 000	125 000	DoH		NSG, DPSA, DCDT, HWSETA
			-	5 000 Com Health Workers trained in Train-the-Trainer	Curriculum Developed	1 250	1 250	1 250	1 250	DoH		NSG, DPSA, DCDT, HWSETA
NEET												
To facilitate digital skills development training and labour market opportunities for young people not in employment, education and training	Increased access to education, training and labour market opportunities by NEETs	To unlock digital learning and skills building opportunities	Digital literacy programme focused on learning and employment opportunities (including self-employment) implemented	-	Digital Literacy Programme Implemented	Curriculum Developed	Piloted	Implemented	Implemented	Revised	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
			Young people trained through train-the-trainer programme to deliver digital literacy programme	-	5 000 young People Trained	-	1 000	3 000	4 000	5 000	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
				-	2,5 million Young People Trained		500 000	1 500 000	2 000 000	2 500 000	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
			Pre-entry level digital skills development programmes developed	-	1 Pre-entry Level Digital Skills Development in Data science, Analytics, and Machine Learning	Curriculum Developed	Piloted	Implemented	Implemented	Revised	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
				-	1 Pre-entry Level Digital Skills Development in Network Engineering including IoT and Cloud	Curriculum Developed	Piloted	Implemented	Implemented	Revised	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
				-	1 Pre-entry Level Digital Skills Development in Materials Science and Additive Manufacturing	Curriculum Developed	Piloted	Implemented	Implemented	Revised	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA, DPSA
				-	80 000 NEETS trained in Pre-entry Level Digital Skills	-	9 000	18 0000	25 000	30 0000	DWYDP/ NYDA	DHET, DEL, NSA, Presidency, GTAC, SAYC, NEMISA,

				Development Programmes							DPSA
		Public and community-based facilities accessed to deliver skills development programmes	-	1 000 Facilities Accessed	-	100	250	250	400	DWYDP/ NYDA	DSAC, COGTA, SALGA
		National framework for recognition of micro-credentialing and digital badging implemented	-	Framework Implemented	Research Undertaken	Concept Paper	Stakeholder Consultation	Regulations Issues	Implemented	SAQA, QCTO	DHET, DEL, DTIC, NSA
	To facilitate access to digital skills building opportunities in public employment programmes, and youth and community service	Digital literacy integrated into the training component of public employment and youth service programmes	-	Digital Literacy Integrated in EPWP Skills Component	Curriculum Review	Digital Literacy Curriculum Developed	Digital Literacy Curriculum Integrated	Digital Literacy Curriculum Implemented	Digital Literacy Curriculum Implemented	DWYDP, NYDA	EPWP, DPWI
			-	Digital Literacy Integrated in National Youth Service Skills Component	Curriculum Review	Digital Literacy Curriculum Developed	Digital Literacy Curriculum Integrated	Digital Literacy Curriculum Implemented	Digital Literacy Curriculum Implemented	DWYDP, NYDA	EPWP, DPWI
			-	Digital Literacy Integrated in Community Works Programme Skills Component	Curriculum Review	Digital Literacy Curriculum Developed	Digital Literacy Curriculum Integrated	Digital Literacy Curriculum Implemented	Digital Literacy Curriculum Implemented	DWYDP, NYDA	COGTA, DPWI
			-	Digital Literacy Integrated in National Rural Youth Service Corps Programme Skills Component	Curriculum Review	Digital Literacy Curriculum Developed	Digital Literacy Curriculum Integrated	Digital Literacy Curriculum Implemented	Digital Literacy Curriculum Implemented	DWYDP, NYDA	DRLR
			-	500 000 Young People Completed Skills Component in Public Employment and Youth Service Programmes	-	-	100 000	200 000	200 000	DWYDP, NYDA	EPWP, DPWI COGTA, DRLR
		Corporates participating in digital rewards programme for public and community service by NEETs	-	1 000 Corporates	Programme Design	100	250	250	400	DWYDP, NYDA	EPWP, DPWI COGTA, DRLR, DSD, DEFF, DoH, BUSA
			-	R100 million Mobilized	Programme Design	R10m	R20m	R30m	R40m	DWYDP, NYDA	EPWP, DPWI COGTA, DRLR, DSD, DEFF, DoH, BUSA
		NEETs registered for participation in the digital rewards programme for public and community service	-	1 million Parting NEETs	Programme Design	50 000	200 000	350 000	400 000	DWYDP, NYDA	EPWP, DPWI COGTA, DRLR, DSD, DEFF, DoH, BUSA
		NEETs established a digital skills and asset portfolio	-	500 000 NEETs	Programme Design	25 000	100 000	175 000	200 00	DWYDP, NYDA	YES, Harambe, EPWP, DPWI COGTA, DRLR, DSD, DEFF, DoH, BUSA
Leadership, Knowledge and Resourcing											

	Outcome	Objective	Output	Baseline	Target	Y1	Y2	Y3	Y4	Y5	Lead	Relevant Departments & Agencies
To effectively mobilise leadership, institutional and funding resources for the implementation of the digital and future skills programme	Institutionalised the provision of digital skills in the education, training and skills development ecosystem	To build a digital and future skills implementation platform	Established governance and management structures	-	Governance & Management Structures Operationalised	Governance & Management Structures Operationalised	Governance & Management Structures Operationalised	Governance & Management Structures Operationalised	Governance & Management Structures Operationalised	Governance & Management Structures Operationalised	DCDT	Relevant Departments & Agencies
			Enabled secure data-sharing across multiple databases and management information systems	-	Data-sharing Platform Established	Design	Business Plan	Implemented	Implemented	Implemented	DCDT	Relevant Departments & Agencies
			Performance dashboard implemented to track performance	-	Dashboard Implemented	Design	Implemented	Implemented	Implemented	Implemented	DCDT	Relevant Departments & Agencies
			Digital Skills Awareness Campaign Implemented	-	Digital Skills Awareness Campaign Implemented	Design	Implemented	Implemented	Implemented	Implemented	GCIS, DCDT	Relevant Departments & Agencies
		To build a knowledge base on digital skills demand and supply	Digital Skills Observatory established and maintained	-	Digital Skills Observatory Operationalised	Design	Business Plan	Implemented	Implemented	Implemented	DCDT/ DHET	Relevant Departments & Agencies
			Annual State of Digital Skills Report produced	-	4 State of Digital Skills Reports Produced	Design	1	1	1	1	DCDT/ DHET	Relevant Departments & Agencies
			Various knowledge resources and products produced and packaged	-	8 Issues Papers	1	1	2	2	4	DCDT/ DHET	Relevant Departments & Agencies
				-	18 Policy Briefs	2	4	4	4	4	DCDT/ DHET	Relevant Departments & Agencies
				-	4 Trend Analysis Reports	-	1	1	1	1	DCDT/ DHET	Relevant Departments & Agencies
			Digital skills development research community of practice established	-	Community of Practice Established	Inception	Operational	Operational	Operational	Operational	DCDT/ DHET	Relevant Departments & Agencies
		To mobilise funding to support digital skills development	Digital Development Fund (DDF) Established	-	Digital Development Fund Established	Design	Piloted	Operationalised	Operational	Operational	NT, DCDT	
			DDF funding mobilised	-	R1 billion Mobilised	-	R250m	R250m	R250m	R250m	NT, DCDT	
			NSF funding mobilised for digital skills development	-	R500m Mobilised	-	R125m	R125m	R125m	R125m	NT, DCDT	NSF, SETAs
			LAP-UIF funding mobilised for digital skills development	-	R500m Mobilised	-	R125m	R125m	R125m	R125m	NT, DCDT	DEL, LAP
			Jobs Fund funding mobilised for digital skills development	-	R250m Jobs Fund	-	R75m	R75m	R75m	R75	NT, DCDT	Jobs Fund
				-	R250m Jobs Fund Co-funding Mobilised	-	R75m	R75m	R75m	R75	NT, DCDT	Jobs Fund
			International development cooperation funding mobilised	-	R500m Mobilised	-	R125m	R125m	R125m	R125m	NT, DCDT	DIRCO

List of Resources

Note: This list of resources is compiled for implementers to read and digest, to consult, in order to gain deeper insight into the nature of digital skills building and to encounter ideas about building future skills.

Alabi, M., de Beer, D., Wichers, H., & Kloppers, C. (2019). Framework for effective additive manufacturing education: a case study of South African universities. *Rapid Prototyping Journal*, *26*(5), 801 - 826. https://doi.org/10.1108/RPJ-02-2019-0041

Centre for Competition, Regulation and Economic Development (CCRED). (2018). *Structural transformation in South Africa: Moving towards a smart, open economy for all*. https://static1.squarespace.com/static/52246331e4b0a46e5f1b8ce5/t/5ad9e4baf950b76753 1fe8a9/1524229357942/IDTT+Structural+Transformation+in+South+Africa+Moving+towards +a+smart%2C+open+economy+for+all.pdf

Centre for Competition, Regulation and Economic Development (CCRED). (2019). *Towards a digital industrial policy for South Africa: A review of issues*. https://static1.squarespace.com/static/52246331e4b0a46e5f1b8ce5/t/5d355997ae8bf40001 ee2906/1563777435535/DPIP_Final.pdf

Competition Commission. (2019). *Data services market inquiry final report: Summary of findings and recommendations*. http://www.compcom.co.za/wp-content/uploads/2019/12/Data-Services-Inquiry-Summary.pdf

De Lannoy, A., Graham, L., Patel, L., & Leibbrandt, M. (2018). *What drives youth unemployment and what interventions held? A systematic overview of the evidence and a theory of change*. High-level overview report. https://www.uj.ac.za/faculties/humanities/csda/Documents/Youth%20Unemployment%20rep ort%20FINAL%20interactive.pdf

Department of Basic Education (DBE). (2018a). *Human resources development strategy for early childhood development*. Pretoria: DBE. https://www.education.gov.za/Portals/0/Documents/Publications/4.pdf?ver=2020-03-09-141936-040

Department of Basic Education (DBE). (2018b). *Professional development framework for digital learning*. https://www.education.gov.za/Portals/0/Documents/Publications/Digital%20Learning%20Fra mework.pdf?ver=2018-07-09-101748-953

Department of Basic Education (DBE). (2019a, March). DBE and partners workshop: Coding and robotics curriculum for the GET band. *Thuto*, 227(29). https://www.education.gov.za/Portals/0/Documents/Publications/Thuto%20Volume%20227% 20D3.pdf?ver=2019-03-29-113915-510

Department of Basic Education (DBE). (2019b). *E³ baseline study report*. https://www.ecubed-dbe.org/wp-content/uploads/2020/07/20200416_E3-2019-Baseline-Report_Master.pdf

Department of Basic Education (DBE). (2020a). *Annual Report 2019/20.* https://www.education.gov.za/Portals/0/Documents/Reports/Annual%20Report%20FY1920. pdf?ver=2020-11-06-165526-607

Department of Basic Education (DBE). (2020b, 17 March). ICT rollout. Portfolio Committee Presentation. https://pmg.org.za/files/200317ICT_ROLL-OUT.pptx

Department of Communications and Digital Technologies (DCTD). (2020). Diagnostic report of the Presidential Commission on the Fourth Industrial Revolution (Notice 513). *Government Gazette*, 43730, 23 September 2020.

Department of Health (DoH). (2019). *The National Digital Health Strategy for South Africa 2019 – 2024*. http://www.health.gov.za/index.php/2014-08-15-12-54-26?download=3651:national-digital-health-strategy-for-south-africa-2019-2024

Department of Higher Education and Training (DHET). (2013). *Policy on professional qualifications for lecturers in technical and vocational education and training*. Government Gazette, 36554 (576), 11 June 2013.

Department of Higher Education and Training (DHET). (2020). *Statistics on post-school education and training in South Africa 2018*. https://www.dhet.gov.za/SiteAssets/Statistics%20on%20Post-School%20Education%20and%20Training%20in%20South%20Africa%2C%202018.pdf

du Preez, W. B., & de Beer, D. J. (2015). Implementing the South African Additive Manufacturing Roadmap – The role of an Additive Manufacturing Centre of Competence. *The South African Journal of Industrial Engineering*, 26(2), 85 – 92. http://sajie.journals.ac.za/pub/article/view/1179/611

Ellis, L., Nunn, S., & Avella, T. (2016). Digital badges and micro-credentials: Historical overview, motivational aspects, issues and challenges. In Ifenthaler, D., Bellin-Mularski, N., & Mah, D. (Eds.). *Foundation of digital badges and micro-credentials: Demonstrating and recognising knowledge and competencies*. Chan: Springer International.

ETDP-SETA. (2019). *TVET subsector report for the 2019-20 Sector Skills Plan*. http://www.etdpseta.org.za/education/sites/default/files/2020-06/TVET%20Sub-sector%20Report%20for%20the%202019-20%20Sector%20Skills%20Plan.pdf

Graham, L., De Lannoy, A., Rosa, S. & Breakey, J. (2019) *Towards a basic package of support for youth in South Africa. Policy review report and recommendations on an institutional approach*. Cape Town: SALDRU, University of Cape Town & Centre for Social Development in Africa, University of Johannesburg. (SALDRU Working Paper No. 254). http://opensaldru.uct.ac.za/bitstream/handle/11090/969/2019_254_Saldruwp.pdf?sequence=3

Hall, K., Sambu, W., Almeleh, C., Mabaso, K., Giese, S. & Proudlock, P. (2019). *South African Early Childhood Review 2019*. Cape Town: Children's Institute, University of Cape Town/ Ilifa Labantwana. http://childrencount.uct.ac.za/uploads/publications/SA%20ECR_2019.pdf

Harambee Youth Employment Accelerator. (2020). *Final report: Mapping of digital and ICT roles and demand in South Africa*. http://digital.harambee.co.za/wp-content/uploads/2020/11/HAR964-ICT-Roles-and-Demand-Support-R2.pdf

JCSE & IITPSA. (2019). *2019 JCSE-IITPSA ICT skills survey*. Tenth Edition. https://www.iitpsa.org.za/wp-content/uploads/2019/09/2019-JCSE-IITPSA-ICT-Skills-Survey-v1.pdf

International Labour Organisation (ILO). (no date). The global initiative on decent jobs for youth. https://www.ilo.org/global/topics/youth-employment/databases-platforms/global-initiative-decent-jobs/lang--en/index.htm

International Labour Organisation (ILO). (1999). *Decent work*. Report of the Director-General. International Labour Conference, 87th Session. https://www.ilo.org/public/libdoc/ilo/P/09605/09605(1999-87).pdf

International Labour Organisation (ILO). (2018). Guide on measuring decent jobs for youth: Monitoring, evaluation and learning in labour market programmes. https://www.ilo.org/employment/areas/youth-employment/WCMS_627307/lang--en/index.htm

International Labour Organisation (ILO). (2020). *The digitization of the TVET and skills system*. https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/documents/publication/wcms_752213.pdf

International Labour Organisation (ILO). (2020). *Trends and new developments in employment services to support transitions in Sub-Saharan Africa, the Middle East and North Africa regions*. https://www.ilo.org/global/publications/working-papers/WCMS_764365/lang--en/index.htm

International Telecommunication Union (ITU). (no date). How to leverage coding bootcamps to create job opportunities for youth and women. https://www.itu.int/en/ITU-D/Digital-Inclusion/Youth-and-Children/Pages/Coding-bootcamps-training.aspx

International Telecommunication Union (ITU). (no date). Boosting decent jobs and enhancing skills for youth in Africa's digital economy. https://www.itu.int/en/ITU-D/Regional-Presence/Africa/Pages/projects/2020/jobs-skills.aspx

International Telecommunication Union (ITU). (no date). ICT resources for youth: Employment & entrepreneurship [database]. https://www.itu.int/net4/ITU-D/cds/sis/Youth/Resources/index.asp

International Telecommunication Union (ITU). (2000, January). ILO-ITU digital skills for jobs campaign to equip 5 million youth with job-ready digital skills. https://www.itu.int/en/ITU-D/Digital-Inclusion/Youth-and-Children/Pages/Digital-Skills.aspx

International Telecommunication Union (ITU). (2013). *The ICT opportunity for a disability-inclusive development framework.* https://www.itu.int/en/ITU-D/Digital-Inclusion/Pages/Digital_Inclusion_Resources/ICT_Opportunity_Disability_Inclusive_Dev.aspx

International Telecommunication Union (ITU). (2013). *Universal Service Fund and digital inclusion for all*. https://www.itu.int/en/ITU-D/Digital-Inclusion/Pages/Digital_Inclusion_Resources/Universal_Service_Funds_Digital_Inclusion.aspx

International Telecommunication Union (ITU). (2014). *Digital opportunities: Innovative ICT solutions for youth employment*. https://www.itu.int/en/ITU-D/Digital-Inclusion/Youth-and-Children/Pages/Youth-Employment-and-Entrepreneurship.aspx

International Telecommunication Union (ITU). (2017). *Access to telecommunication/ICT services by persons with disabilities and with specific needs*. http://handle.itu.int/11.1002/pub/80ec6ecc-en

International Telecommunication Union (ITU). (2018). *Digital skills toolkit*. https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/ITU%20Digital%20Skills%20Toolkit.pdf

Kagiso Trust. (2019). *Citizen's knowledge and perceptions about the 4ᵗʰ Industrial Revolution*. https://www.kagiso.co.za/wp-content/uploads/2019/10/Citizens-Knowledge-and-Perceptions-about-4IR.pdf

Kedama, Y., & Abrahams, L. (2017). The state of digital "tech" hubs in South Africa. Briefing note. Prepared for the ICASA-Wits Business Breakfast held on 22 February 2017. https://www.wits.ac.za/media/wits-university/faculties-and-schools/humanities/research-entities/link/documents/Kedama-Abrahams-2017-Tech-Hubs.docx

Kickert, W., Klijn, E., & Koppenjan, J. (1999). *Managing complex networks: Strategies for the public sector*. London: SAGE.

Ledwaba, L. (2020). The management of the Internet connectivity in the South African public libraries. *Library Philosophy and Practice (e-journal)*. 3652. https://digitalcommons.unl.edu/libphilprac/3652

Ledwaba, L., Mugwisi, T., & Jiyane, G. (2020). Examining the extent of Internet access in public libraries in South Africa. *Mousaion: South African Journal of Information Studies*, 38(2). https://doi.org/10.25159/2663-659X/7693

Malinga, S. (2020, January 8). DBE to use AI platform to support robotics curriculum. *ITWeb*. https://www.itweb.co.za/content/xnklOvzbQP2v4Ymz

National Library of South Africa (NLSA). (2020). *2020 – 2025 Strategic plan*. https://www.nlsa.ac.za/wp-content/uploads/2020/07/Strat-Plan-2020-2025-20-feb-lowres.pdf

National Planning Commission. (2011). National Development Plan 2030: Our future – make it work. Executive Summary. https://www.gov.za/sites/default/files/Executive%20Summary-NDP%202030%20-%20Our%20future%20-%20make%20it%20work.pdf

National Planning Commission. (2019). *Youth labour market transitions*. https://www.nationalplanningcommission.org.za/assets/Documents/NPC%20Youth%20Labour%20Market%20Transitions%20Report.pdf

National Planning Commission. (2020a). *Analysis of PSET trends towards NDP 2030*. Draft NPC Report. https://www.nationalplanningcommission.org.za/assets/Documents/Post%20School%20Education%20and%20Training%20(PSET)%20Trends%20towards%202030.pdf

National Planning Commission (2020b). *Digital futures: South Africa's digital readiness for the Fourth Industrial Revolution*. Draft Report. https://www.nationalplanningcommission.org.za/assets/Documents/DIGITAL%20FUTURES%20-%20SOUTH%20AFRICA'S%20READINESS%20FOR%20THE%20FOURTH%20INDUSTRIAL%20REVOLUTION.pdf

National Treasury. (2020). *2020 Medium Term Budget Policy Statement Speech*. http://www.treasury.gov.za/documents/mtbps/2020/speech/speech.pdf

NEDLAC. (2019). *Futures of work in South Africa*. Report prepared by the Institute for Futures Research. http://nedlac.org.za/wp-content/uploads/2017/10/Futures-of-Work-in-South-Africa-Final-Report-March-2019.pdf

New South Wales Government, Department of Finance, Services and Innovation. (2018). Benefits Realisation Management Framework, Part 1: Principles. https://www.finance.nsw.gov.au/publication-and-resources/benefits-realisation-management-framework

Ndlovu, N. (2015). *The pedagogical integration of ICTs by seven South African township secondary school teachers* [Doctoral thesis, University of the Witwatersrand]. http://wiredspace.wits.ac.za/bitstream/handle/10539/20692/NSN%20PhD%20Thesis.docx.pdf?sequence=2

OC&C Strategy Consultants. (2018). *Tech entrepreneurship ecosystem in South Africa*. https://www.occstrategy.com/media/1295/tech-entrepreneurship-ecosystem-in-south-africa.pdf

Oyedemi. T. (2018). The theory of digital citizenship. In Servaes, E. (ed.). *Handbook of communication for development and social change*. Springer: Singapore. https://doi.org/10.1007/978-981-10-7035-8_124-1.

Public Service Sector Education and Training Authority (PSETA). (2020). *2020/21 Sector Skills Plan*. http://www.pseta.org.za/wp-content/uploads/2020/05/Sector-Skills-Plan-Update-2020-21.pdf

Reddy V., Juan A., Isdale K., Fongwa S. (2019). Mathematics achievement and the inequality gap: TIMSS 1995 to 2015. In Spaull N., Jansen J. (eds). *South African schooling: The enigma of inequality*. Policy Implications of Research in Education, Volume 10. Cham: Springer. https://doi.org/10.1007/978-3-030-18811-5_9

Republic of South Africa (RSA). (2016, March 9). *White Paper on the rights of persons with disabilities*. Government Gazette 39792: 5 – 197. https://www.gov.za/documents/white-paper-rights-persons-disabilities-official-publication-and-gazetting-white-paper#

Republic of South Africa (RSA). (2020a, October 23). *Diagnostic report of the Presidential Commission on the Fourth Industrial Revolution*. Government Gazette 43834: 181 – 347.

Republic of South Africa (RSA). (2020b, October 23). *Summary report and recommendations*. Presented by the Commission on the Fourth Industrial Revolution. Government Gazette 43834: 122 – 180.

SmartStart. (2020). *Closing the gap in South Africa's early learning provision: The case for a national delivery platform*. https://www.smartstart.org.za/wp-content/uploads/2020/09/200701_National_Delivery_Report_WEB.pdf

South Africa in the Digital Age (SADA). (2020). *Pathways to digital work: A strategy primer for South Africa's digital economy*. Report compiled by Genesis Analytics. https://www.genesis-analytics.com/uploads/Pathways-to-Digital-Work-SADA-Strategy-Primer-full-report.pdf

Spaull N. (2019.) Equity: A price too high to pay?. In Spaull N., Jansen J. (eds). *South African schooling: The enigma of inequality.* Policy Implications of Research in Education, Vol 10. Cham: Springer. https://doi.org/10.1007/978-3-030-18811-5_1

Statistics South Africa (StatsSA). (2019). *Inequality trends in South Africa: A multidimensional diagnostic of inequality*. Report No. 03-10-19. http://www.statssa.gov.za/publications/Report-03-10-19/Report-03-10-192017.pdf

Statistics South Africa (StatsSA). (2020, February 24). *Vulnerability of youth in the South African labour market*. http://www.statssa.gov.za/?p=13379

Tiwana. A. (2014). *Platform Ecosystems: Aligning Architecture, Governance, and Strategy*. Amsterdam: Morgan Kauffman

UNESCO. (2012, December). ICTs in early childhood care and education. *Institute for Information Technology in Education (IITE) Policy Brief*. https://unesdoc.unesco.org/ark:/48223/pf0000224207

UNESCO-UIS. (2019). *A global framework of reference for digital literacy skills for indicator 4.4.2*. http://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf

Western Cape Department of Economic Development and Tourism (WC DEDAT) (2019). *Capacity Building Programme for Employment Promotion As-Is Report: Digital Skills for the Future - Western Cape Digital Skills Shared Agenda for Action*. https://www.westerncape.gov.za/sites/www.westerncape.gov.za/files/skills_boost_western_cape_-_as_is_-_final_report.pdf

Wildschut, A., & Kruss, G. (2019). Workplace-based learning programmes and the transition to the labour market. In Rogan, M. (ed). *Post-school education and the labour market in South Africa*. Pretoria: HSRC Press.