Western Cape Government
Economic Development and Tourism

Sub-programme 7.1

Provincial Skills and Partnership

Skills Intelligence Report

On

Digital Transformation in the Western Cape

2020/2021 Performance Reporting Period

Quarter 2

OFFICIAL SIGN-OFF

It is hereby certified that this Skills Intelligence Report on Digital Transformation:

- Was developed by the Provincial Skills and Partnership Team, under the guidance of the Director: Ms M Parker and is aligned to the Skills Framework.

- Was developed to align to the Output Indicator: Number of Skills Intelligence Reports produced and linked to Strategies VIP#2: Growth and Jobs and VIP#3: Empowering People.

- Was developed based on Stakeholder Engagements and Desktop Research.

- Is grounded both in a practical understanding of the Western Cape's skills; needs; priorities; the production; and use of market intelligence for Skills planning.

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The objective of the Skills Intelligence Report on Digital Transformation in the Western Cape is to:

Provide a broad overview of the Digital Transformation landscape in the Western Cape by:

PART A: Global overview of Digital Transformation

- Presenting a worldview of Digital Transformation;
- Reflecting on the impact of the COVID-19 Pandemic on Digital Transformation.

PART B: Digital Transformation within the Priority Sectors of the Western Cape

- Mapping the current digital trends as it relates to priority sectors identified by the Department of Economic Development and Tourism (DEDAT), and the skills implications relating to it.

PART C: Academic Supply within the Western Cape

- Mapping the current supply pipeline as it relates to digital skills trends identified. Focus areas of supply relates to the following Educational and Training institutions in the Western Cape:
  - ✓ Western Cape Education Department;
  - ✓ Technical Vocational Educational Authorities (SETA's); and
  - ✓ Post School Education and Training Institutions (PSET). In this report it is also being referred to as Higher Education Institutions (HEI's).

PART D: Conclusion and Recommendation

- Developing a view of the digital skills landscape in the Western Cape from the demand and supply data presented;
- Develop a view of the 'To Be' digital landscape within the Western Cape; and
- Develop an Implementation Plan from recommendations.

Scope of work

- Desktop research to identify and provide a descriptive overview of (International, South African and Western Cape specific) digital skills related research/publications as it relates to user digital skills within the strategic priority sectors of the Western Cape, namely Retail and Wholesale, Business Process Outsourcing Services, Financial

Services, ICT, Manufacturing (inclusive of Marine Manufacturing), Oceans Economy, Tourism and Agri-Processing sectors.

- Desktop research and stakeholder interviews to obtain a descriptive overview of digital skills initiatives (supply) within Basic Education and Higher Education Institutions (viz. universities, TVET colleges).

Project deliverables

Refer to the full report

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List of Acronyms

4IR	Fourth Industrial Revolution
AI	Artificial Intelligence
AR	Augmented Reality
AUV	Autonomous Underwater Vehicles
B2C	Business 2 Consumer
BANKSETA	Bank Sector SETA
BI	Business Intelligence
BPO	Business Process Outsourcing
BPS	Business Process Services
BRICS	Brazil Russia India China South Africa
C2C	Customer 2 Customer
CAD	Computer-aided Design
CAT	Computer Application Technology
CATHSSETA	Culture, Art, Tourism, Hospitality and Sport SETA
CCNA	Cisco Certified Network Associate
CET	Community Education and Training
CETA	Construction Education and Training SETA
CHEC	Cape Higher Education Consortium
CHIETA	Chemical Industry Education & Training Authority SETA
CoS	Centres of Specialisation
COVID-19	Coronavirus Disease 2019
CPUT	Cape Peninsula University of Technology
DBE	Department of Basic Education
DEDAT	Department of Economic Development and Tourism
DHET	Department of Higher Education and Training
EWSETA	Energy & Water Sector SETA
ETDP SETA	Education, Training and Development SETA
FAS	Financial and Accountancy Services Sector
FASSET	Financial and Accounting Services SETA
FDI	Foreign Direct Investment
FET	Further Education and Training
FP&M SETA	Fibre Processing & Manufacturing SETA
FDI	Foreign Direct Investment
GBS	Global Business Services

GDP	Gross Domestic Product
GET	General Education and Training
GDPR	General Data Protection Regulation
HEI	Higher Education Institution
IATA	International Air Transport Association
ICT	Information & Communication Technology
IDI	ICT Development Index
IIOT	Industrial Internet of Things
ILO	International Labour Organization
INSETA	Insurance Sector Education and Training Authority
INSURTECHS	Insurance Technology Innovation Companies
IoT	Internet of Things
IT	Information Technology
LGSETA	Local Government SETA
LMS	Learner Management System
M2M	Machine 2 Machine
MERSETA	Manufacturing, Engineering and Related Services SETA
MICTSETA	Media, Information and Communication Technologies SETA
ML	Machine Learning
MOOC	Massive Open Online Course
MR	Mixed Reality
MSME	Micro, small and medium enterprises
MVNO	Mobile Virtual Network Operators
NBPP	National Broadband Policy and Plan
NDP	National Development Plan
NEET	Not in Employment, Education or Training
NGP	New Growth Path
NOLS	National Open Learning System
NSDS	National Skills Development Strategy
OECD	Organization for Economic Co-operation and Development
PICC	Presidential Infrastructure Coordinating Commission
PIVOTAL	Professional Vocational Technical and Academic Learning
PoPI	Protection of Personal Information
PQM	Programme Quality Mix
PSET	Post School and Education System

PSETA	Public Sector SETA
PSP	Provincial Skills and Partnerships
QCTO	Quality Council on Trades and Occupations
RPA	Robotic Process Automation
RPL	Recognition of Prior Learning
SAQA	South African Quality Assurance Authority
SETA	Sectoral Education and Training Authority
SERVICESSETA	Services SETA
SIC	Standard Industrial Classification
SME	Small Medium Enterprise
SMME	Small, Medium and Micro Enterprises
SSP	Sector Skills Plan
STEM	Science Technology Engineering & Mathematics
SUN	Stellenbosch University
TIO	Total Integrated Automation
TIP	Total Integrated Power
TVET	Technical and Vocational Education Training
UNESCO	United Nations Educational Scientific and Cultural Organizations
UCT	University of Cape Town
UWC	University of the Western Cape
UNISA	University of South Africa
UNWTO	United Nation World Tourism Organisation
VIP	Vision Inspired Priority
VR	Virtual Reality
WAAM	Wire Arc Additive Manufacturing
WCED	Western Cape Education Department
WCG	Western Cape Government
WCP	Western Cape Province
WEF	World Economic Forum
WFH	Work from Home

1 Introduction

Two (2) of the five (5) priorities for the Western Cape Government (WCG), relates to Vision Inspired Priority (VIP2) – Growth and Jobs; and (VIP3) - Empowering People. The priority of empowering people aims to provide all citizens of the Western Cape, with an opportunity to reach their full life potential and live lives they value. This priority takes a holistic human development approach from conception, through the education phases, adulthood and concludes in retirement.

The White Paper for Post-School Education and Training[1] observes that "*although South Africa has put in place a range of ambitious measures to improve skills planning, the system has neither produced good information about skills needs, nor increased the quality of provision in areas needed by the economy*". In addition, The National Skills Development Strategy (NSDS III) indicates that there is currently no institutional mechanism that provides credible information and analysis, with regards to the supply and demand of skills. It states that "*while there are a number of disparate information databases and research initiatives, there is no standardised framework for determining skills supply, shortages and vacancies, and there is no integrated information system for skills supply and demand across government*".[2]

The Skills Intelligence Report produced by the Sub-Programme: Provincial Skills and Partnership (PSP) will be both a practical and strategic demonstration of facilitative engagements across the skills pipeline within the Western Cape, to drive the provision of credible information, analysis and signals on the demand and supply of skills as an important contribution to the establishment of the institutional mechanism, for skills planning in the Western Cape.

The Skills Intelligence Report will encompass a high-level overview of Digital Transformation and its impact on the economic Sectors in the Western Cape. This will include an overview of the Education and Training landscape to understand the role of the various stakeholders, which includes the three (3) Government spheres and Industry supporting the digital skills ecosystem.
Market intelligence will be outlined to indicate the supply of skills in the Province, in alignment to the jobs and skills demands required by priority sectors that drive the Economy.

[1] Department of Higher Education and Training (2013): White Paper on Post School Education and Training
[2] Department of Higher Education and Training (2011): National Skills Development Strategy III

Western Cape Government
Economic Development and Tourism

PART A

GLOBAL VIEW OF DIGITAL TRANSFORMATION

1 International Context for Digital Skills Transformation

[3]In 2017, the McKinsey Global Institute estimated that as many as 375 million workers—or 14 percent of the global workforce—would have to switch occupations or acquire new skills by 2030 because of automation and artificial intelligence. In a recent McKinsey Global Survey, 87 percent of executives said they were experiencing skill gaps in the workforce or expected them within a few years. But less than half of respondents had a clear sense of how to address the problem.[4]

[5]As technological breakthroughs rapidly shift the frontier between the work tasks performed by humans and those performed by machines and algorithms, global labour markets are likely to undergo major transformations. These transformations, if managed wisely, could lead to a new age of good work, good jobs and improved quality of life for all, but if managed poorly, pose the risk of widening skills gaps, greater inequality and broader polarization. In many ways, the time to shape the future of work is now.

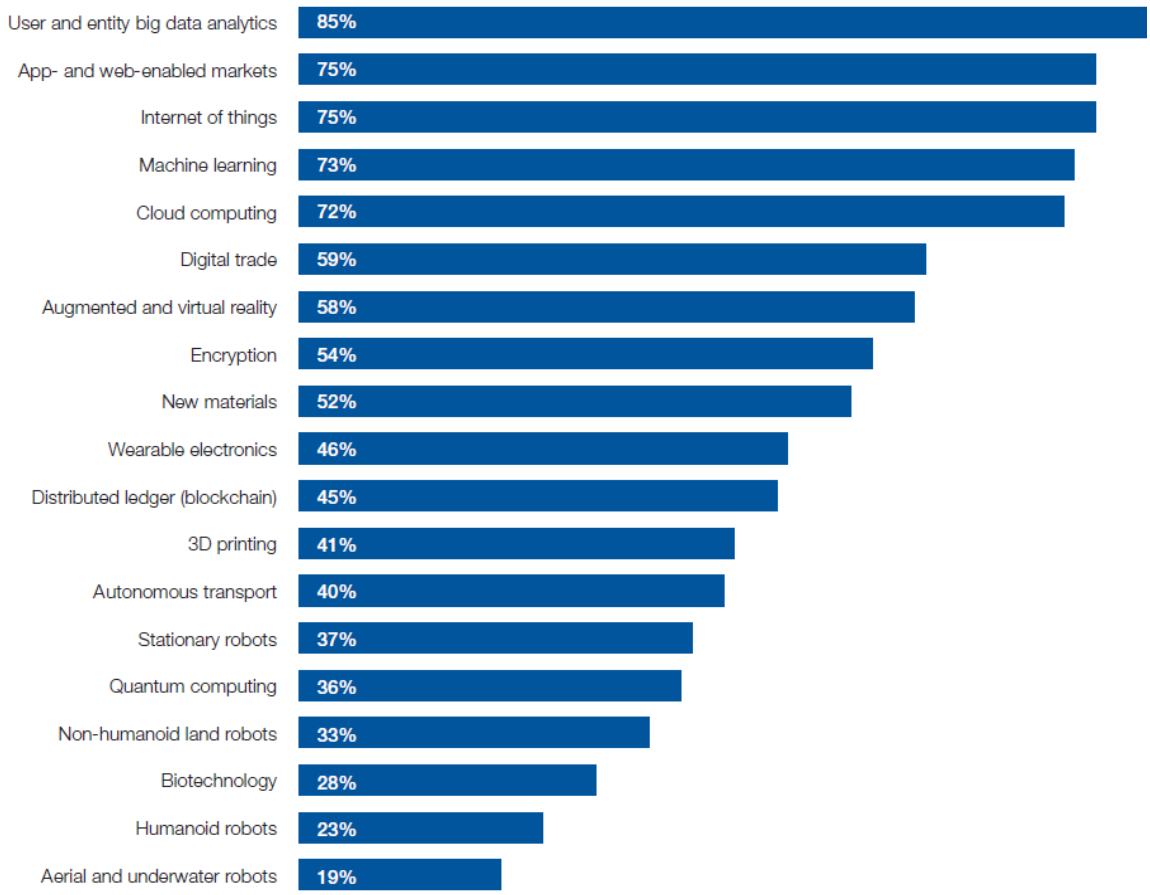
1.1 Key International Trend Drivers for Digital Transformation

1.1.1 Strategic Drivers for New Business Models

[6]As the Fourth Industrial Revolution (4IR) unfolds, companies are seeking to harness new and emerging technologies to reach higher levels of efficiency of production and consumption. Through technological adoption, they can expand into new markets and compete on new products for a global consumer base composed of digital natives. Even as technological advancements pose challenges to existing business models and practices, the same dynamics of technological advances are set to be the primary drivers for new growth (Figure 1).

[3] World Economic Forum, Future of Jobs Report, 2018)
[4] McKinsey Global Institute (2020): To emerge stronger from the COVID-19 crisis, companies should start re-skilling their workforces now
[5] World Economic Forum, Future of Jobs Report, 2018
[6] World Economic Forum, Future of Jobs Report, 2018

Figure 1: Technologies by proportion of companies likely to adopt them by 2022 (projected)



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

1.1.2 The Future of Jobs Across All Industries

The future of jobs diverging by industry and sector, which is being influenced the distribution of tasks, different investments in technology adoption, and the skills availability and adaptability of the workforce (Table 1). Among the trends driving growth across industries over the 2018-2022 period, advances in mobile internet are likely to have a distinct impact in the Aviation, Travel & Tourism industry, the Financial Services & Investors industries, and in the Consumer industry.

The rapid adoption of new technologies by consumers as well as advancement in Cloud Technology are set to drive growth in the Information & Communication Technologies (ICT) industry. The availability of Big Data is expected to have an even broader impact on the Financial Services & Investors and Energy & Technologies Industries. New energy suppliers and

technologies, in tandem with advances in computing power, are set to drive gains in the Energy & Technologies sector.

Among non-technological drivers of business growth, increasing affluence in developing economies is poised to drive growth in the Aviation, Travel & Tourism; Global Health & Healthcare; and Chemistry, Advanced Materials & Biotechnology industries.

Table 1: Technology adoption by Industry and share of companies surveyed, 2018-2022 (%)

	Overall	Automotive, Aerospace, Supply Chain & Transport	Aviation, Travel & Tourism	Chemistry, Advanced Materials & Biotechnology	Consumer	Energy Utilities & Technologies	Financial Services & Investors	Global Health & Healthcare	Information & Communication Technologies	Infrastructure	Mining & Metals	Oil & Gas	Professional Services
User and entity big data analytics	85	84	89	79	85	85	86	87	93	65	62	87	85
App- and web-enabled markets	75	76	95	71	88	65	89	80	93	53	50	61	74
Internet of things	75	82	95	58	73	85	65	67	86	76	50	83	74
Machine learning	73	87	79	58	82	77	73	80	91	53	69	70	74
Cloud computing	72	76	79	67	67	73	65	73	91	71	62	78	76
Digital trade	59	68	68	62	82	58	70	53	70	47	50	57	59
Augmented and virtual reality	58	71	68	50	48	65	59	67	72	59	62	65	53
Encryption	54	58	53	25	42	38	73	67	67	41	25	57	53
New materials	52	71	32	79	79	65	22	60	30	82	62	83	41
Wearable electronics	46	61	53	46	45	42	49	73	49	24	25	70	35
Distributed ledger (blockchain)	45	32	37	29	39	54	73	67	67	18	38	48	50
3D printing	41	61	21	58	42	54	19	53	35	41	50	57	29
Autonomous transport	40	74	58	54	39	46	16	20	44	41	50	30	41
Stationary robots	37	53	37	50	42	35	27	47	35	35	38	52	29
Quantum computing	36	29	32	25	33	46	43	33	44	24	19	43	41
Non-humanoid land robots	33	42	26	21	36	27	32	40	37	29	25	30	24
Biotechnology	28	18	0	42	52	42	11	87	23	12	44	39	24
Humanoid robots	23	29	26	17	18	8	35	13	33	12	25	13	24
Aerial and underwater robots	19	18	16	17	12	35	5	0	19	29	25	52	21

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

The growth potential of new technological expansion is buffered by multi-dimensional skills gaps across the global and local markets, and among the leadership of enterprises. Skills gaps among the local market are among the most cited barriers to appropriate technology adoption for many industries (Table 2). This particularly in industries such as Aviation Travel and Tourism, ICT, Financial Services & Investors, and Mining and Metals industry.

Table 2: Projected (2022) effects on the Workforce by Industry and proportion of Companies (%)

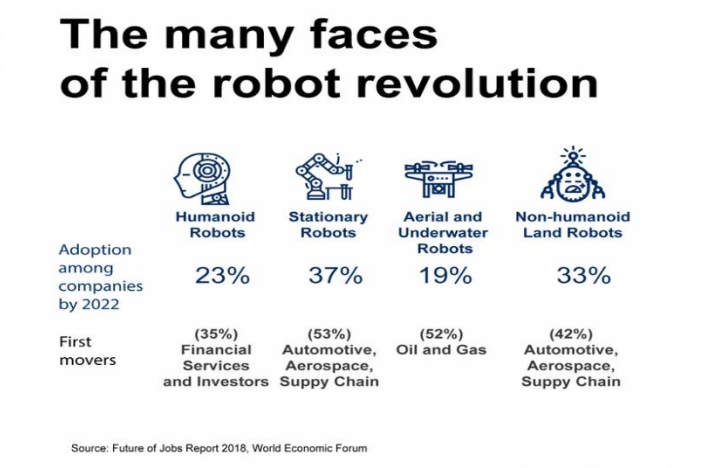
	Overall	Automotive, Aerospace, Supply Chain & Transport	Aviation, Travel & Tourism	Chemistry, Advanced Materials & Biotechnology	Consumer	Energy Utilities & Technologies	Financial Services & Investors	Global Health & Healthcare	Information & Communication Technologies	Infrastructure	Mining & Metals	Oil & Gas	Professional Services
Modify value chain	59	82	44	71	83	78	56	67	55	78	44	87	60
Reduce workforce due to automation	50	48	50	38	57	56	56	47	55	33	72	52	37
Expand task-specialized contractors	48	52	50	42	51	52	44	33	57	56	56	52	51
Modify locations of operation	48	42	50	58	54	52	67	73	55	28	44	57	54
Expand the workforce	38	50	39	38	34	19	31	27	41	28	22	35	71
Bring financing on-board for transition	36	38	33	29	40	37	31	20	34	56	22	30	37
Expand workforce due to automation	28	20	50	29	23	19	25	20	52	22	33	26	57

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

1.1.3 Automation, robotization and digitization look different across different industries

Companies look to machine learning and augmented and virtual reality for considerable business investment. Stationary robots are likely to be the most widely adopted by 2022 – but different industries have distinct use cases and preferences (Figure 2).

Figure 2: The many faces of Robotics



1.1.4 A net positive outlook for jobs – amid significant job disruption

In purely quantitative terms, 75 million current job roles may be displaced by the shift in the division of labour between humans, machines and algorithms, while 133 million new job roles may emerge at the same time. A cluster of emerging job roles will gain significant importance over the coming years, while other cluster of job profiles are set to become increasingly redundant (Table 3).

Growing occupations include roles such as Data Analysts, Software and Applications Developers and E-commerce and Social Media Specialists – jobs that are significantly based on, and enhanced by, the use of technology. However, also expected to grow are job roles (Figure 3) based on distinctively 'human' traits, such as Customer Service Workers, Sales and Marketing Professionals, Training and Development, People and Culture, and organizational Development Specialists as well as Innovation Managers.

Table 3: Examples of stable, new and redundant roles - all Industries

Stable Roles	New Roles	Redundant Roles
Managing Directors and Chief Executives	Data Analysts and Scientists*	Data Entry Clerks
General and Operations Managers*	AI and Machine Learning Specialists	Accounting, Bookkeeping and Payroll Clerks
Software and Applications Developers and Analysts*	General and Operations Managers*	Administrative and Executive Secretaries
Data Analysts and Scientists*	Big Data Specialists	Assembly and Factory Workers
Sales and Marketing Professionals*	Digital Transformation Specialists	Client Information and Customer Service Workers*
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products	Sales and Marketing Professionals*	Business Services and Administration Managers
Human Resources Specialists	New Technology Specialists	Accountants and Auditors
Financial and Investment Advisers	Organizational Development Specialists*	Material-Recording and Stock-Keeping Clerks
Database and Network Professionals	Software and Applications Developers and Analysts*	General and Operations Managers*
Supply Chain and Logistics Specialists	Information Technology Services	Postal Service Clerks
Risk Management Specialists	Process Automation Specialists	Financial Analysts
Information Security Analysts*	Innovation Professionals	Cashiers and Ticket Clerks
Management and Organization Analysts	Information Security Analysts*	Mechanics and Machinery Repairers
Electrotechnology Engineers	Ecommerce and Social Media Specialists	Telemarketers
Organizational Development Specialists*	User Experience and Human-Machine Interaction Designers	Electronics and Telecommunications Installers and Repairers
Chemical Processing Plant Operators	Training and Development Specialists	Bank Tellers and Related Clerks
University and Higher Education Teachers	Robotics Specialists and Engineers	Car, Van and Motorcycle Drivers
Compliance Officers	People and Culture Specialists	Sales and Purchasing Agents and Brokers
Energy and Petroleum Engineers	Client Information and Customer Service Workers*	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers
Robotics Specialists and Engineers	Service and Solutions Designers	Statistical, Finance and Insurance Clerks
Petroleum and Natural Gas Refining Plant Operators	Digital Marketing and Strategy Specialists	Lawyers

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

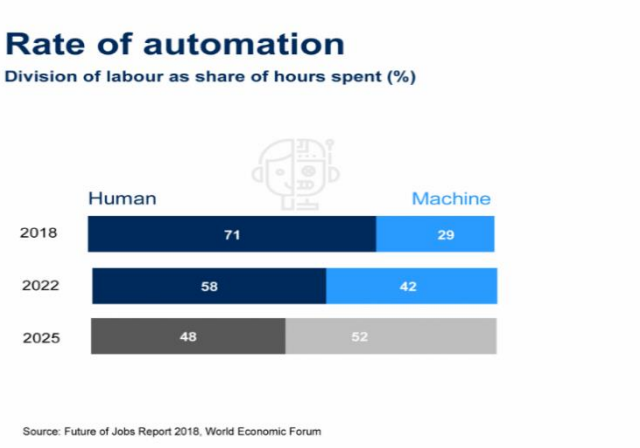
Note: Roles marked with * appear across multiple columns. This reflects the fact that they might be seeing stable or declining demand across one industry but be in demand in another.

Figure 3: Changes in the Jobs landscape in 2022

1.1.5 The division of labour between humans, machines and algorithms is shifting fast

Employers anticipate a significant shift in the division of labour between humans, machines and algorithms for the tasks of today. Currently an average of 71% of total task hours across the industries covered by the Future of Jobs Report are performed by humans, compared to 29% by machines or algorithms (Figure 4).

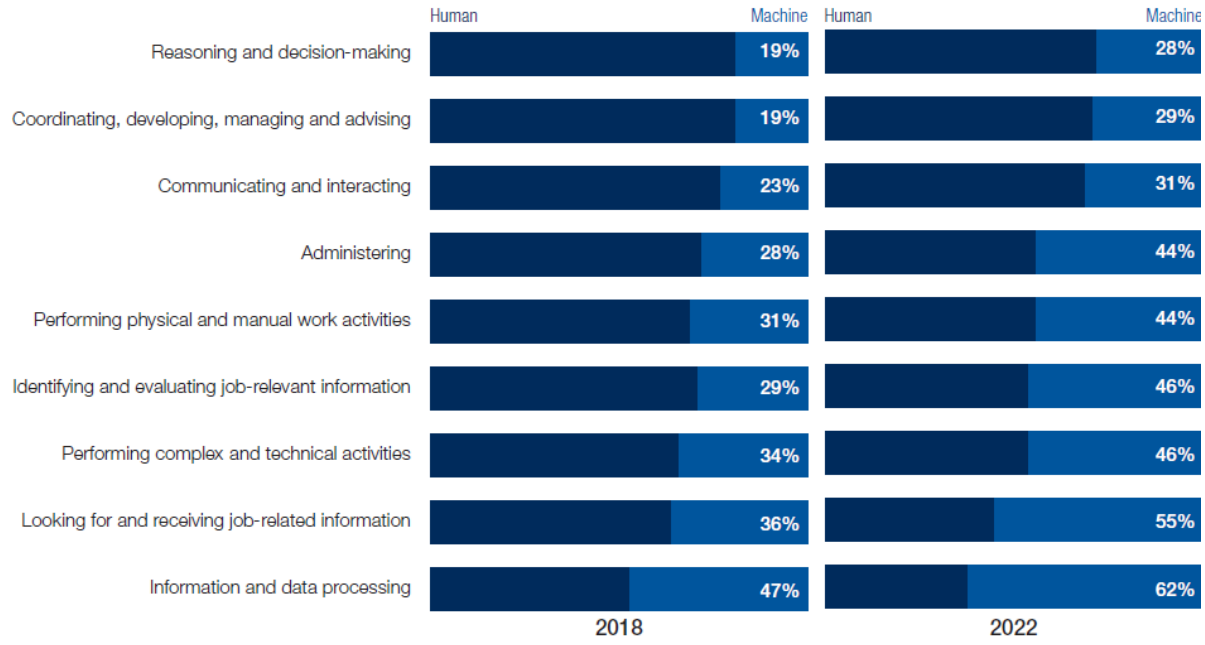
Figure 4: Human Tasks vs Automation



By 2022 this average is expected to have shifted to 58% task hours performed by humans, and 42% by machines or algorithms. In terms of total working hours, no work task is yet performed predominantly by machines or algorithms today (Figure 5). By 2022, 62% of organization's data processing and information search and transmission tasks will be performed by machines. Relative to their

starting point today, the expansion of machines' share of work task performance will be particularly marked in reasoning and decision-making, administrative and information search tasks. Even work tasks overwhelmingly performed by humans today — communicating, interacting, coordinating, managing and advising — will begin to be taken on by machines, although to a lesser degree.

Figure 5: Ratio of human machine working hours, projected 2018 vs 2022



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

1.1.6 New tasks at work are driving demand for new skills

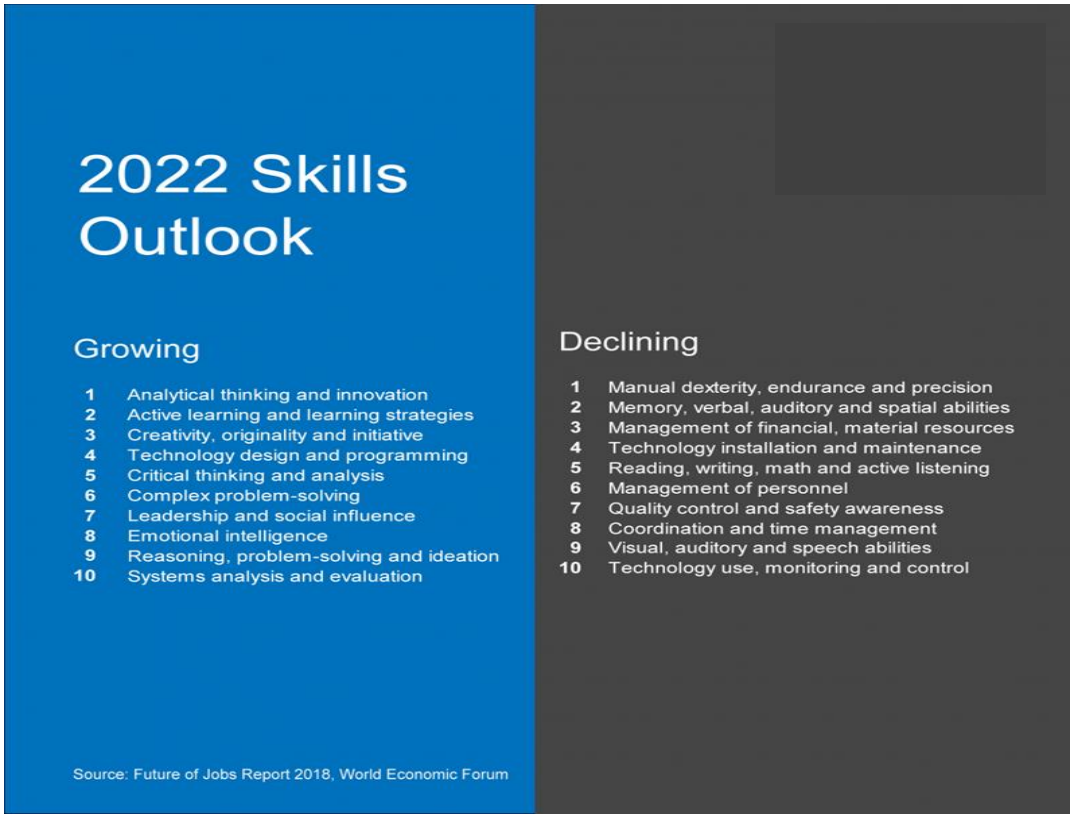
The proportion of core skills required to perform a job that will remain the same is expected to be about 58%. That means workers will see an average shift of 42% in required workplace skills in the period leading up to 2022. Skills growing in prominence include analytical thinking and active learning as well as skills such as technology design, highlighting the growing demand for various forms of technology competency.

Changes in technology will also influence an increase in the demand of '*human skills*', i.e. creativity, originality and initiative, critical thinking, persuasion and negotiation will likewise retain or increase their value, as will attention to detail, resilience, flexibility and complex problem-solving. Emotional

intelligence, leadership and social influence as well as service orientation are also set to see increase in demand relative to their current prominence today.

Figure 6 below outlines the skills that will have prominence by 2022.

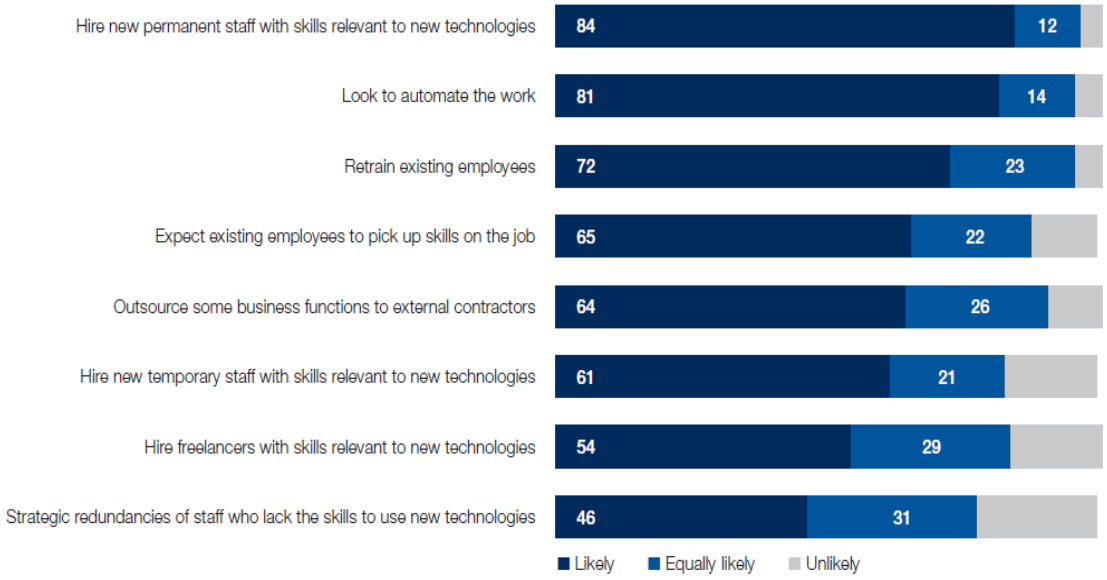
Figure 6: Changes in Skills Demand by 2022



1.1.7 We will all need to become lifelong learners

Current technological shifts underway in the workforce will displace some workers, and at the same create new opportunities for others. Coherent responses from companies are required from companies to find win-win solutions for employees and companies bottom line. In creating an agile workforce, and prevent displacement of employees, companies must create a workforce augmentation strategy to ensure success in these two divergent matters (Figure 7).

Figure 7: Projected (2022) strategies to address shifting skills needs, by proportion of Companies (%)

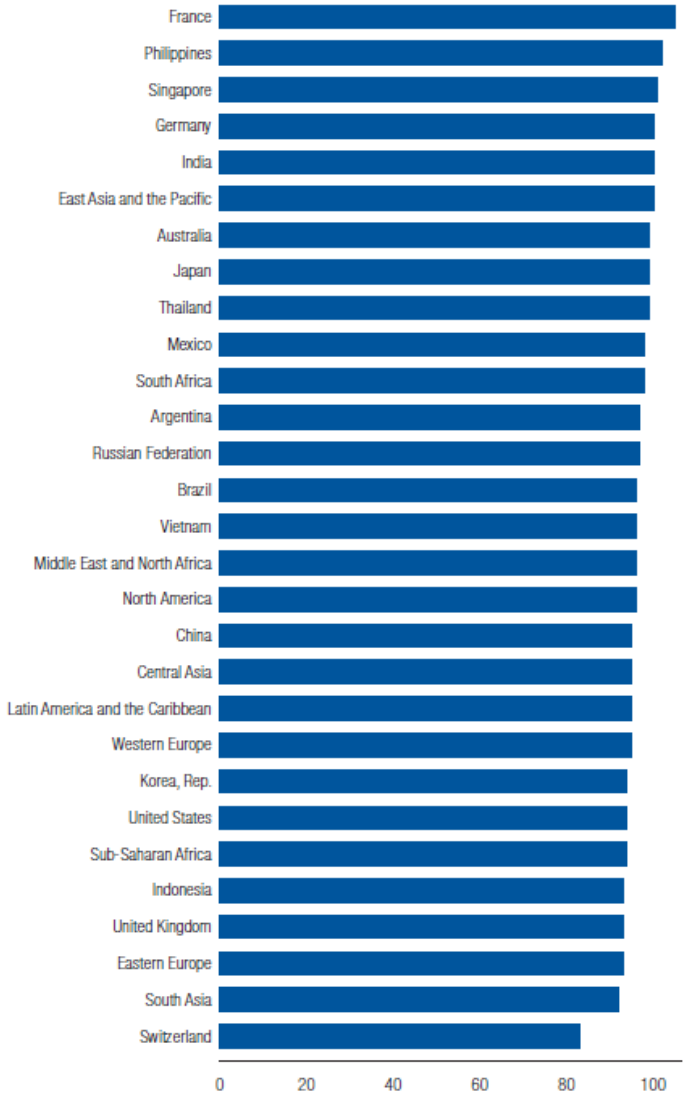


Source: Future of Jobs Survey 2018, World Economic Forum.

Note: The bars represent the proportion of responses by companies that stated that specific strategies were likely, equally likely or unlikely. Some companies abstained from answering the question. In such cases part of the bar remains blank (typically, 0–1% in the graph above).

Upskilling and reskilling of the workforce is an important component of a workforce augmentation strategy. It is projected that on, employees will need 101 days of retraining and upskilling in the period up to 2022 (Figure 8). Depending on industry and geography, between one-half and two-thirds of companies are likely to turn to external contractors, temporary staff and freelancers to address their skills gaps. Currently, only 30% of employees in today's job roles with the highest probability of technological disruption have received any kind of professional training over the past 12 months. The reskilling and upskilling strategies of companies remains unclear and require greater attention. The time requirements, costs, success cases and appropriate models for delivery of reskilling and upskilling the workforce are likely to look very different for different categories of jobs and roles and workers.

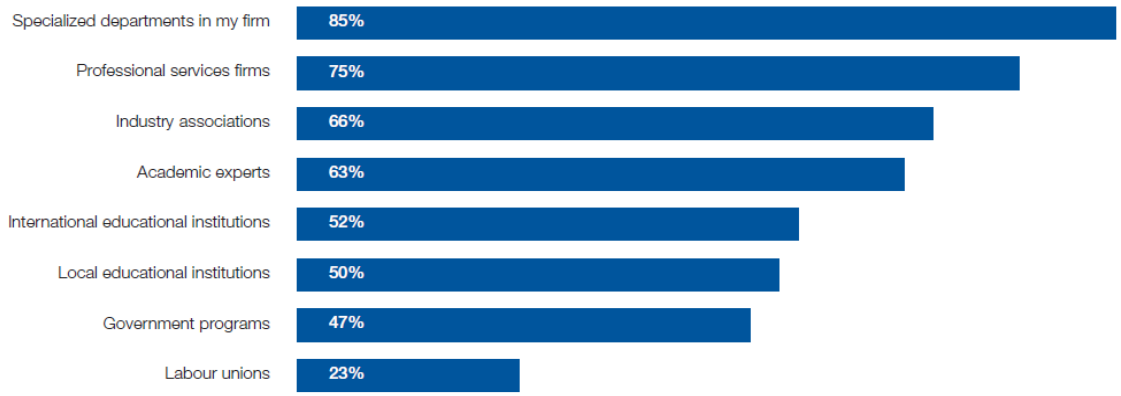
Figure 8: Average re-skilling needs in days, Country and Region, 2018-2022



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

While companies themselves must take the lead in developing a capable workforce within their organisation, the economic and societal nature of these challenges means that they will also increasingly need to partner with stakeholders for the retaining and upskilling of employees (Figure 9). Tangible collaboration opportunities include partnering with educators to reshape school and college curricula, intra- and inter-industry collaboration on building talent pipelines and partnerships with labour unions to enhance cross-industry talent mobility. Governments may become a key partner in creating incentives for lifelong learning, ensuring shared standards for retraining and strengthening safeguards for workers transition.

Figure 9: Preferred partners in managing integration of new technologies and workforce transition



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

For government and businesses alike, there is a significant opportunity in strengthening cross-sectorl multi-stkeholder collaboration to promote corportae reskilling and upskilling of employees aming countries and regions. Currently, employers primarily seek out support of their own internal departments, as well as private training providers to deliver on reskilling and upskilling intitaives between the period 2018-2022.

Across many regions, the least sought after partner are local education institutions, government programms and labour unions. This narrows the field for envisaged partnerships, and highlights both a need and opportunity for expanding the range of multi-stakeholder collaboration.

2 COVID-19 Pandemic Impact on Digital Transformation

This digital mandate isn't new; it's simply been brought into sharp focus. Prior to the pandemic, a paradigm shift towards digitization and servitization of the economy was already underway. Current events have accelerated the paradigm, as evidenced by the marked shift in spending towards digital businesses.[7]

[7] BDO (2020): COVID-19 is accelerating the rise of the digital economy: Digital Transformation in the Pandemic & Post-Pandemic Era

Remote working was gaining currency before the crisis, but the pandemic has shown that telecommuting is here to stay.[8] In the old style of working, a "job" is defined as supervised attendance at the workplace. Being employed means having a "job", which means that one is paid to spend a certain number of hours each month at a place of work. This is usually understood as a specific physical space in an office provided by the employer. Measurements of an employee's performance are usually relative to time spent at the workplace and managers track delivery through inspection.[9]

Working from home (WFH) fundamentally changes the definition of a job. In the future, jobs will be deconstructed into a set of activities or tasks. In thinking about a "*job*" we will no longer see it as belonging to an individual. The tasks within a job might be done by different individuals or might even be automated and done by robots. While there will still be tasks that require physical presence, this will likely be the focus of moves to drive automation. A redefinition of the notion of a job brings into focus the issue of how work is measured and how it is managed. There will be a requirement for new tools and processes. These tools will be designed to give management oversight of tasks. The output of tasks will need to be monitored, measured and coordinated.[10]

Social distancing and the WFH will result in society adapting to working more interactively with chatbots, robots and other forms of automation. An important prerequisite for wide-scale automation is the availability of data. This seems set to become a reality, based partly on the increased use of Machine 2 Machine (M2M) communication and the Internet of Things (IoT).[11]

Companies should craft a talent strategy that develops employees' critical digital and cognitive capabilities, their social and emotional skills, and their adaptability and resilience. According to the McKinsey Global Institute there are three skilling trends are likely to speed up after the crisis ends:

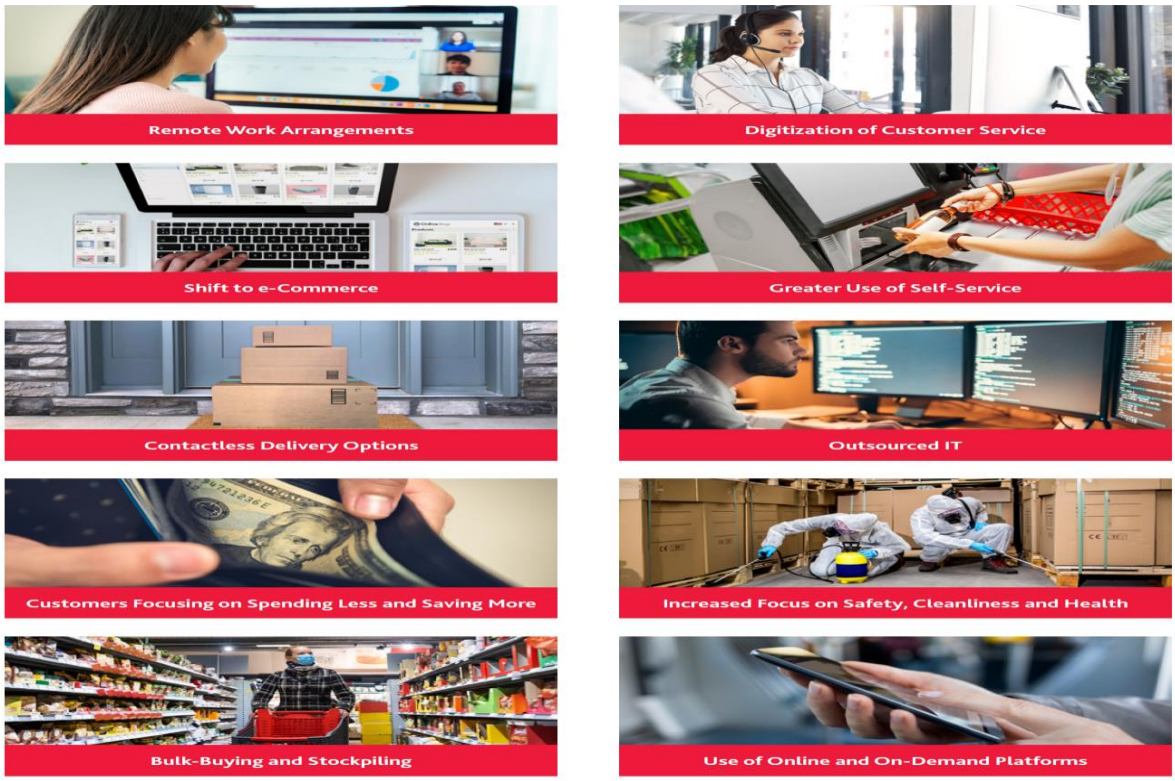
1. New skills for the '*distance economy*'
2. Imbalances in talent supply and demand

[8] McKinsey Global Institute (2020): To emerge stronger from theCOVID-19 crisis, companies should start re-skilling their workforces now
[9] Dwolatzky, B and Harris, M (2020): The world is flat: Covid-19 becomes the driving force for 4IR
[10] Dwolatzky, B and Harris, M (2020): The world is flat: Covid-19 becomes the driving force for 4IR
[11] Dwolatzky, B and Harris, M (2020): The world is flat: Covid-19 becomes the driving force for 4IR

3. Changes to supply chains[12]

COVID-19 propelled some industries further than others. Those accelerating their digital transformation most significantly in response to COVID-19 were tech companies. Digital technologies have opened up the future remote work opportunities. Digital communication became the new lifeblood for business, and Omnichannel communication took on new importance (Figure 10).

Figure 10: COVID-19 Trends here to stay

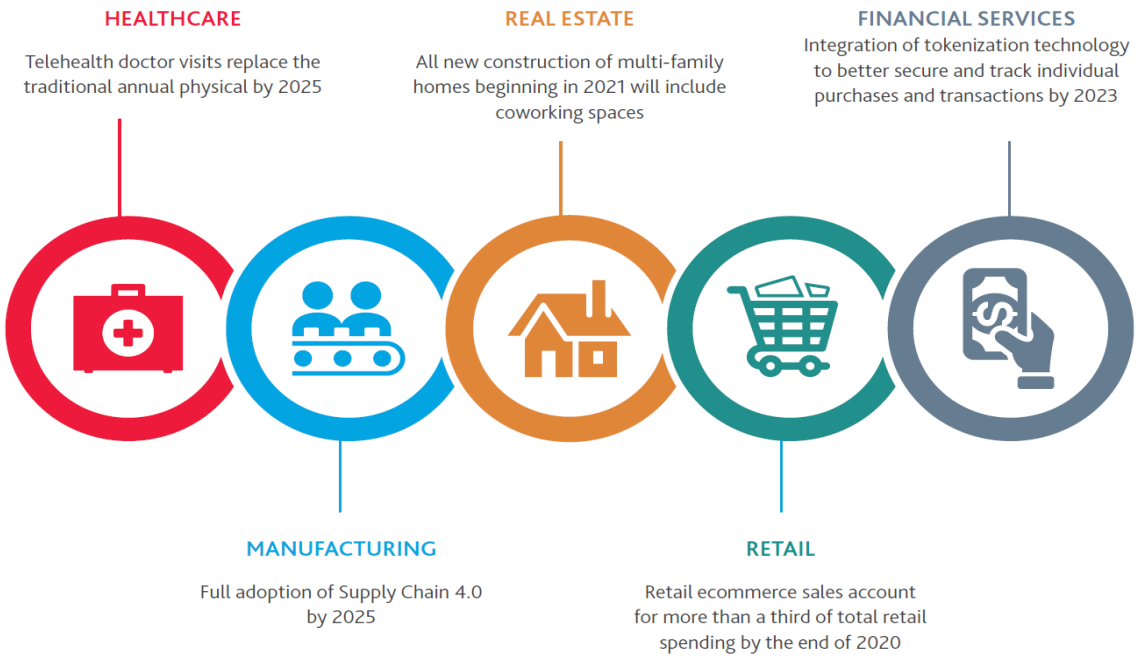


Source: BDO (2020)

The pandemic serves as a widespread test case for the effectiveness of these digital solutions, many of which will be permanent fixtures and lead to long-term changes for many businesses (Figure 11).

[12] McKinsey Global Institute (2020): To emerge stronger from theCOVID-19 crisis, companies should start re-skilling their workforces now

Figure 11: Digital Transformation in the Pandemic & Post-Pandemic Era



Source: BDO 2020

Going digital in and of itself isn't a panacea to all that ails businesses in the current economic environment. They do, however, have significantly more tools at their disposal to not only weather the storm, but to come out the other side stronger for it.

3 South African Readiness for Digital Transformation

In the post-Covid-19 "*new-normal*", businesses that reject outsourcing will simply not scale at the same speed as the ones that do. For the first time, a piece of work done by an individual in South Africa vs someone outside of our country will only be differentiated by quality, speed and cost. While this might not be creating local employment, it does put South Africa in the position to start exporting technology globally, which will have a significant impact on the local economy.[13]

[14]On paper, South Africa has long recognised communications networks as the backbone of the modern economy and society. The National Development Plan (NDP) (2011) provides a framework in which to realise South Africa's vision that by

[13] Dwolatzky, B and Harris, M (2020): The world is flat: Covid-19 becomes the driving force for 4IR
[14] Digital Futures: South Africa's Readiness for the Fourth Industrial Revolution, July 2020, Draft

2030 "…*a widespread broadband communication system will underpin a dynamic and connected vibrant information society and a knowledge economy that is more inclusive, equitable and prosperous.*" Yet, national commitments to ICTs that followed the NDP in the Presidential Infrastructure Coordinating Commission (PICC) and via the National Broadband Policy and Plan (NBPP), SA Connect, have failed to meet set targets or make significant progress to meet specified objectives.

One of the key job-creation drivers identified as part of the economic policy, the New Growth Path (NGP), is the knowledge economy, an economy that is underpinned by the ICT sector. Yet South Africa's economy has slowed to the point of contraction in the past three years, and most industries have struggled to inject value, opportunities and jobs into the market. Given the appropriate policy and regulatory conditions, the ICT sector can, however, serve as an important enabler of growth.

As a key input for other sectors in an increasingly digital economy, and through the creation of new services and formal and informal employment, the ICT sector has the potential to perform far better than it does on global rankings, and more in line with the size, promise and sophistication of South Africa's economy.

The National Integrated ICT Policy states that in order to have a vibrant and inclusive knowledge economy, there is a need to: provide affordable access to communication (equity); increase accessibility of services, devices, infrastructure and content to all citizens (accessibility); improve the quality of life (social development); and ensure proper data governance (user protections), all preconditions of an equitable digital economy and society.

In order to operationalise the NDP, the Government gazetted the National Broadband Policy Plan (NBPP) and Strategy, SA Connect, in 2013. Conceptualising broadband beyondinfrastructure only as it had been done in the early broadband plan in 2009, the policyattempted to lay the ground for an integrated supply- and demand-side strategy to meet the NDP's goals of a dynamic and connected information society and a vibrant knowledge economy that is more inclusive and prosperous. SA Connect proposed a four-pronged supplyand demand-side strategy to meet a range of short- and long-term targets (Figure 12).

Figure 12: SA Connect Four-Pronged Supply and Demand Strategy

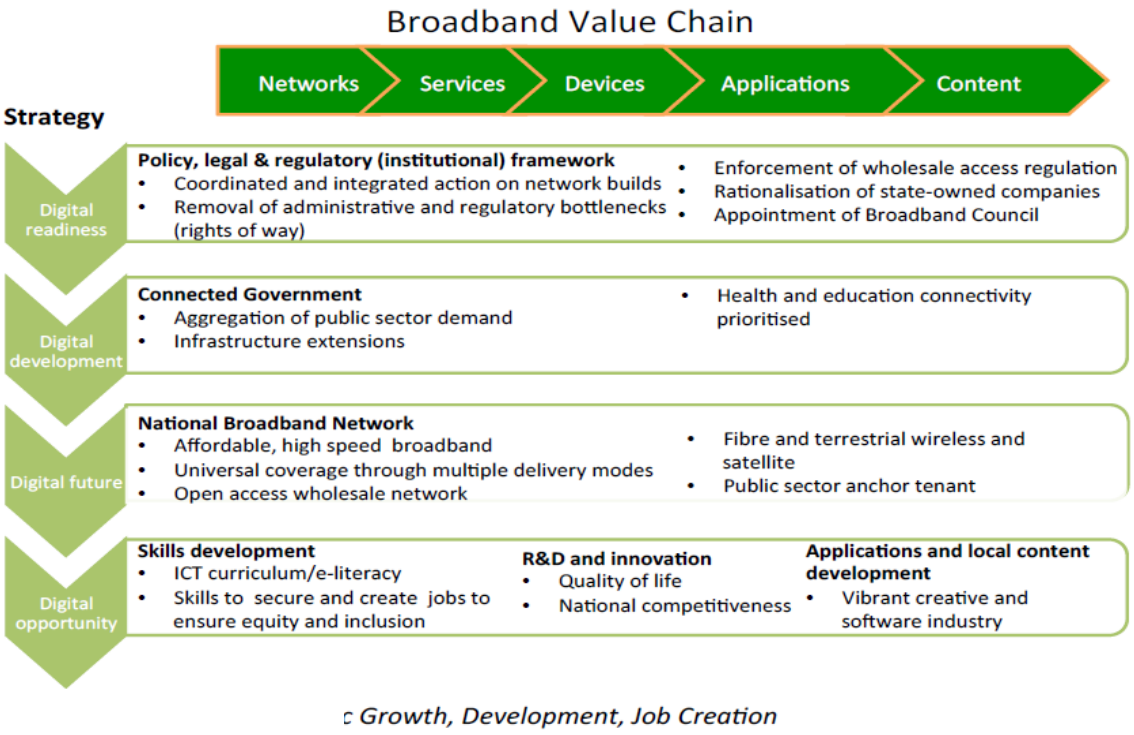


Figure 2: SA Connect Strategy

Source: Department of Communications (2013) SA Connect: Creating Opportunities, Ensuring inclusion – South Africa's Broadband Policy, Policy Brief for Cabinet.

If the policy and broadband plan derived from the NDP, SA Connect, had been implemented from 2013, South Africa may have been in a position to address current challenges arising from the dynamic and increasingly complex digitalised and globalised environment in which it now finds itself. The above becomes evident when noting that South Africa's position on the International Telecommunications Union's ICT Development Index (IDI) continues to decline, from the 84th place in 2011 to 92nd place in 2017.

Rather than focusing narrowly on the potential and dangers of so-called technologies, South Africa needs to develop a transversal digital policy that is far more comprehensive than one focusing on Artificial Intelligence (AI); Machine Learning (ML); Blockchain; and Drones although these would be important forward-looking parts. For the NDP to properly inform the development of a digital economy, it will need to propose a comprehensive, integrated national project to optimise global digitalisation trends in the interest of all. The policy needs to address the entire ICT ecosystem. Such an integrated

policy will enable the country to create the necessary conditions to harness the benefits of advanced technological developments and mitigate the risks associated with them. This will need to cut across all government departments to enable the high level of integrated planning and implementation, as well as the public and private sector coordination, required for an equitable and competitive digital economy.

[15]A key component of achieving universal access and usage service is affordability. South Africa's cost of communication is high when compared to other African countries. The cost of 1 GB of data in South Africa is double the average cost of the same amount of data in the comparative countries. Lack of competition is one of the factors contributing to high prices, and although there are some mobile virtual network operators (MVNOs) present in the country, the mobile market is still dominated by four MNOs. This number is half the number of MNOs in Brazil and Nigeria (eight MNOs each) and fewer than the number in Cambodia (five MNOs), and Ghana (seven MNOs). Table 4 below relfects the disparities South Africa and other African countries.

Table 4: Benchmarking South Africa against affordability

Affordability	Comparison Average	Traffic Light	Country-Level Indicator
Mobile prepaid voice basket (USD)	2.13	●	3.86
Dominant operator: mobile prepaid voice basket (USD)	2.66	●	6.46
Mobile prepaid 1 GB basket (USD)	3.04	●	7.27
Dominant operator: mobile prepaid 1 GB basket (USD)	4.06	●	10.84
Source: RIA After Access Survey, 2017			

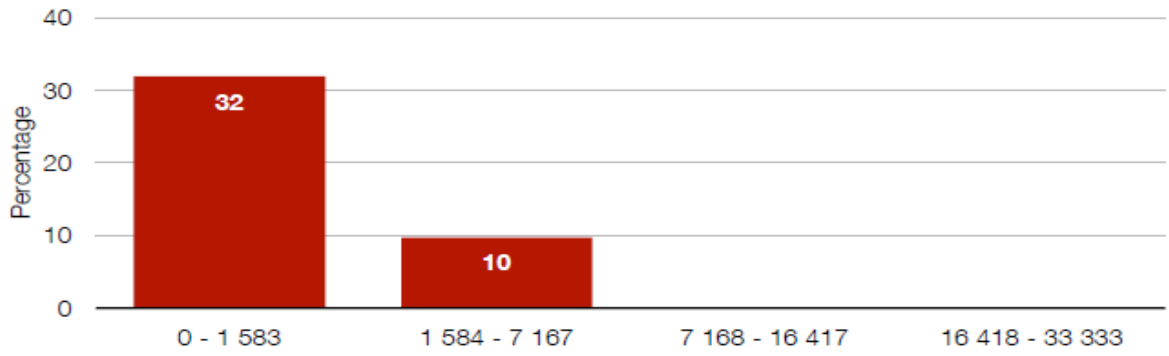
Source: RIA After Access Survey, 2017

A key component to achieving universal access and usage service is affordability. Whether or not telecommunication services are affordable depends primarily on the price (which is determined by the input costs and profit margin of the operator) and the user's disposable income.

[15] Digital Futures: South Africa's Readiness for the Fourth Industrial Revolution, July 2020, Draft

The affordability divide between low-income and high-income South Africans is creating connection barriers for low-income earners, especially as the country has significant income disparities. The survey shows that almost 50% of South Africans do not use the Internet. The unconnected 50% of the population are all at the bottom of the pyramid – evidence that the price of communications in South Africa is unaffordable to the poor (see Figure 13).

Figure 13: Percentage of individuals who do not have access to the Internet, by income group (ZAR)

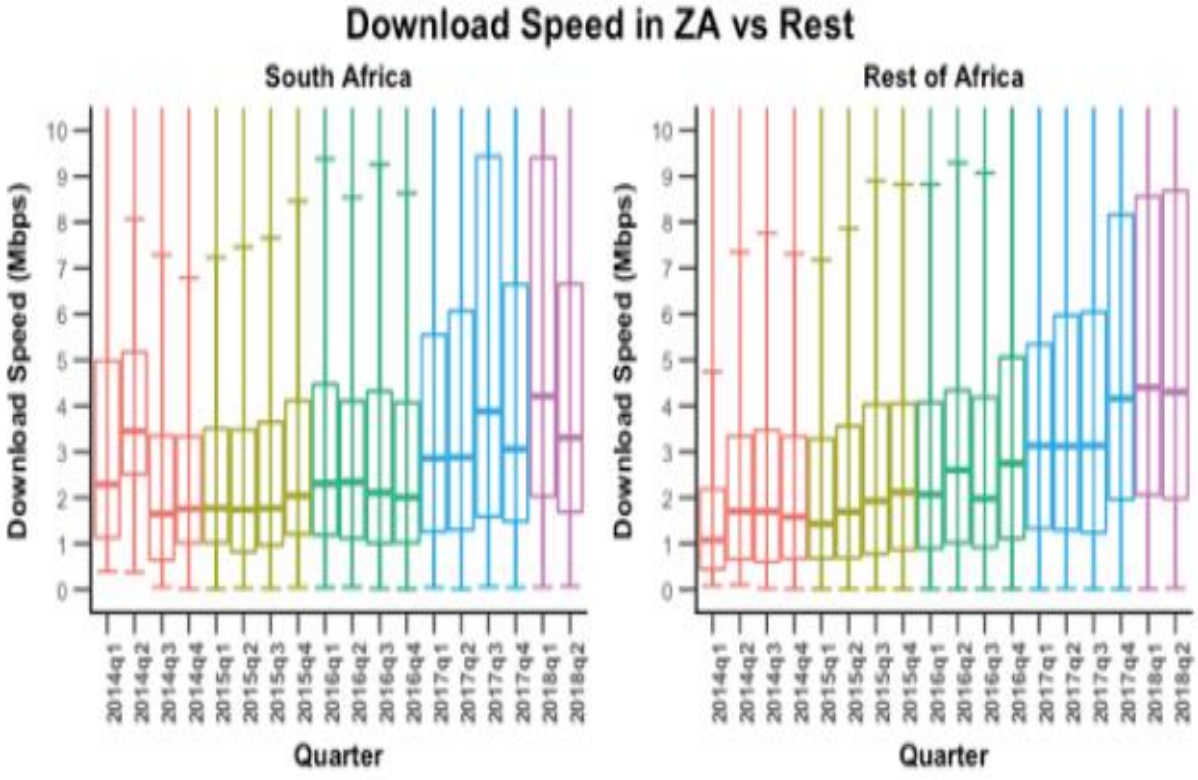


Source: RIA after Access Survey data, 2017

With increasing demand across the continent for video content, streaming media, and services such as cloud computing, broadband performance – and specifically how users experience performance – becomes increasingly important to competitive outcomes in the market. In order to meet the demand for high-usage bandwidth applications, South African operators have invested extensively, increasing capacity through investing in both terrestrial fibre networks and in the provision of mobile LTE networks.

Despite this increase in network capacity, the speed gap between various countries remains very wide, as the five fastest countries have download speeds that are about 40 times faster than the five slowest countries. Of the 39 African countries ranked in a Cable Index, none achieved average roadband speeds above 10 Mbps, with South Africa ranking 80th out of 189, having a mean download speed of 4.36 Mbps. The figure below provides an overview of South Africa's download speed in comparison to African countries.

Figure 14: Download speed in South Africa versus the rest of Africa (Q1 2014-Q2 2018)



Source: SpeedChecker, 2018

The benchmarking against similar size economies in the report demonstrates that South Africa has the potential to perform better digitally and more in line with the size and sophistication of its economy, than it currently is. With the correct complementary policies and strategies, it can drive new services in an increasingly service-based economy; creating new opportunities and potential efficiencies in the informal and informal sector.

Western Cape Government
Economic Development and Tourism

PART B

Digital Transformation within the Priority Sectors of the Western Cape

1 Trends in the Utilisation of Digital Technology in Priority Sectors of DEDAT

Economic sectors are large groups of the economy grouped according to their place in the production chain, by their product or service or ownership. Sectoral programmes and Trade and Investment are seen at all levels of Government as key mechanisms for the country to achieve employment and economic growth potential.

A sectoral approach provides the strategic framework for industry-facing components of any key strategic priorities which would be identified, through a deep understanding of the industry policies, implementation strategies and networks underpinning each Sector. Taking this into consideration, the Digital Transformation within the key sector priorities of the Western Cape will be explored in the section below.

Sectors to be reviewed will include:

1. Agri-Processing Sector;
2. Manufacturing Sector;
3. Finance, Business Services & BPO Sector;
4. Tourism Sector;
5. Wholesale and Retail Sector;
6. Marine and Oceans Economy Sector; and
7. Information Communication Technology (ICT) Sector

1.1 Agri-Processing Sector

1.1.1 Sector Profile

[16]The Standard Industrial Classification (SIC) divides most of Agri processing economic activities into the Manufacturing Section. The definition used for manufacturing is stated as "*physical or chemical transformation of materials, substances, or components into new products… Materials, substances, or compounds transformed are raw materials that are products of agriculture, forestry and fisheries…. Substantial alteration, renovation or reconstruction of goods are generally considered manufacturing*."[17] These economic activities

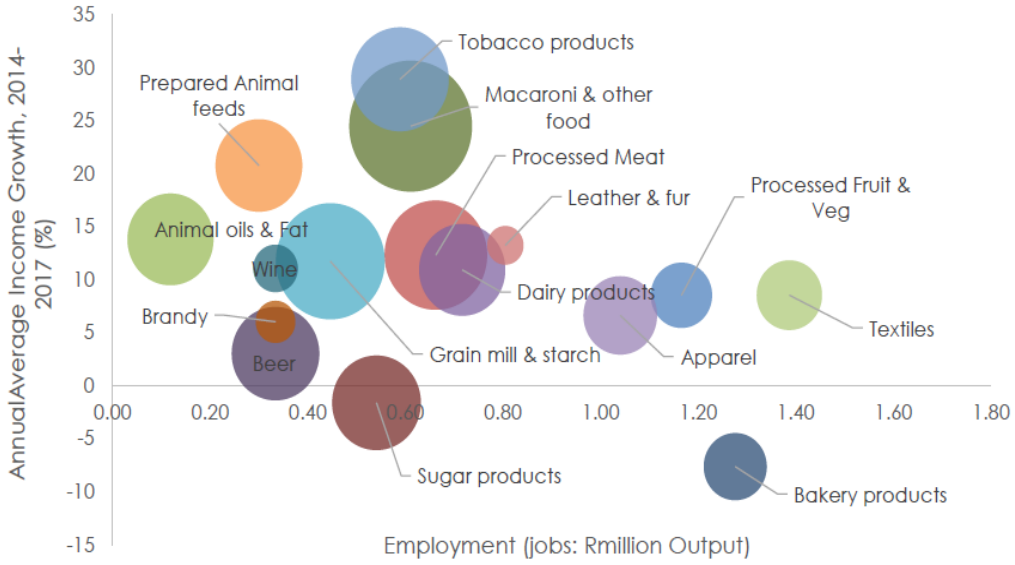
[16] StatsSA, 2012

[17] StatsSA, 2012: p.60

are often carried out by plants, factories or mills and characteristically use power driven machines and material handling equipment.

Figure 13 provides a snapshot of Agri processing industries according to their nominal annual average income growth (y-axis) from 2014 to 2017, their labour intensity (job per R1 million output produced) and the relative size in terms of total income for 2017[18] .

Figure 15: Agri-Processing Sub-Sectors



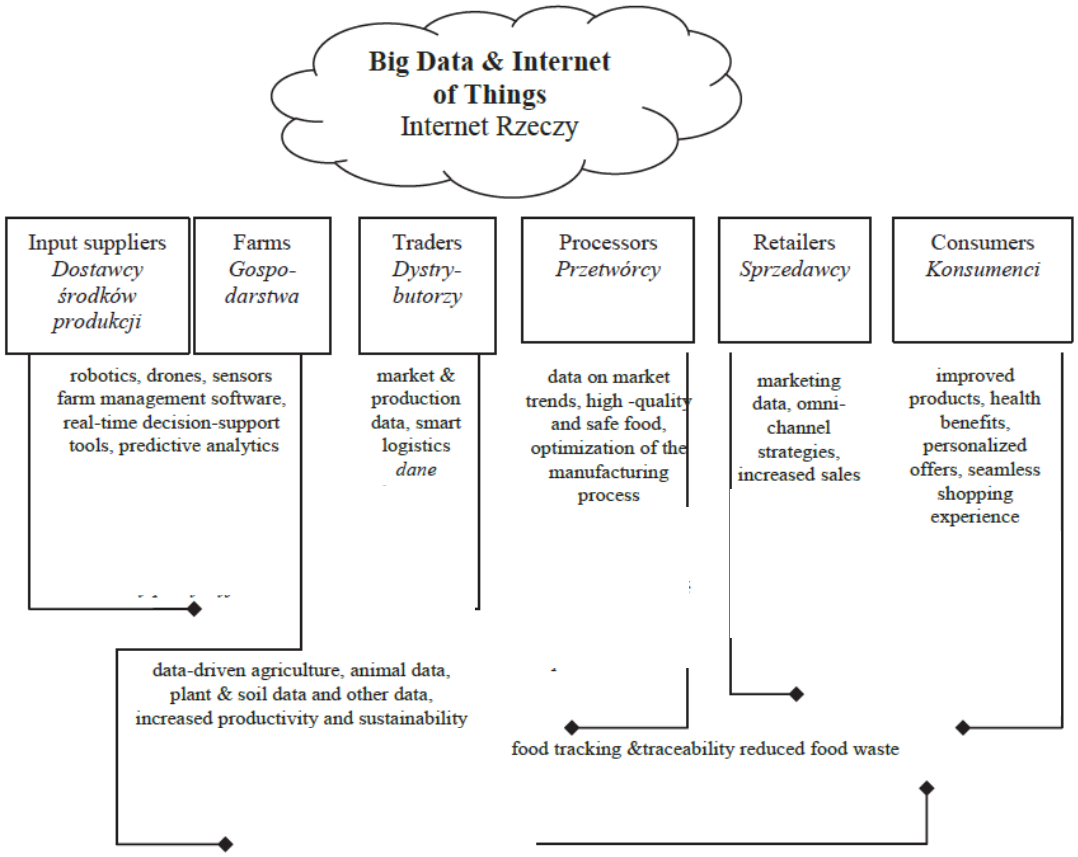
Source: StatsSA 2014;2017

1.1.2 Key Drivers and Technological Change

The prospects for a smart agri-food system have been recently expanded following the emergence of Cloud Computing, Big Data and the Internet of Things, (Figure 14) technologies).

[18] StatsSA, 2014; 2017

Figure 16: Smart Agri-food system based on digital technologies



Source: Digital Transformation in the Agri-Food Sector - Opportunities and Challenges, Article in Roczniki Naukowe Stowarzyszenia Ekonomistów Rolnictwa i Agrobiznesu · May 2018)

Online platforms and dedicated applications provide information concerning prices, markets, access to inputs, finance and risk mitigation measures. moreover, use cases under the research project internet of Food and Farm indicate that digital technologies support an integrated network of actors, processes and information which might translate into more efficient food processing, intelligent food logistics, complete supply chain monitoring and food waste reduction.

1.1.3 Implications for Skills Development

Innovations based on data and digital technologies are expected to increase in the years to come. Recent investment decisions by it and food retail companies focus e.g. on the potential uses of Blockchain Technology to support the management of the global food supply chain and to improve food

safety. This is expected to happen i.e. through increased transparency and more efficient tracing of sources of food contaminations[19].

Digital technologies, e-commerce, mobile apps, beacons and recommendations based on big Data analytics are also changing consumer experiences. Food consumers may now benefit from personalized offers that take heed of their diet, specific nutrition or health needs. Overall, the growing flows of farm and food data combined with digital technologies and computing techniques seem to offer new and promising routes to make the agribusiness more productive, profitable and sustainable.

This coupled with other technological advancements happening within the subsector across the globe indicates that the subsector needs to also invest and research and development initiatives and mentoring and coaching youth into more technical positions within the subsector.

1.2 Manufacturing Sector

1.2.1 Sector Profile

Manufacturing is the processing of raw materials or parts into finished goods using tools, human labour, machinery, and chemical processing. Large-scale manufacturing allows for the mass production of goods using assembly line processes and advanced technologies as core assets.

The discussion of the technological divers within the Manufacturing Sector below includes the following: Clothing; Footwear; Forestry; Furniture; General Goods; Leather; Packaging; Printing; Print Media; Publishing; Pulp and Paper; Textiles and Wood Products; Auto; Motor; New Tyre; Metal; Plastics Sectors.

1.2.2 Key Drivers and Technological Change

[20]The process of Digital Transformation is happening in a range of industries, but perhaps no more so than manufacturing. Advanced Manufacturing is at the heart of the 4IR, shaping the future of production and value chains. It is opening

[19] Peterson, 2017

[20] https://www.weforum.org/agenda/2020/01/the-3-key-ingredients-for-the-digital-transformation-of-manufacturing/

a range of opportunities for companies to transform factories, business models and to shape a new wave of economic growth.

There is five technologies that are positively impacting the manufacturing industry[21]:

1. **The Industrial Internet of Things**

   The Industrial Internet of Things (IIoT) is an amalgamation of various technologies, such as Machine Learning (ML), Big Data, Sensor Data, Cloud Integration and Machine Automation. These technologies are being employed in areas like predictive and proactive maintenance, real-time monitoring, resource optimization, supply-chain visibility, cross-facility operations analysis, and safety, enabling plant managers to minimize downtime and enhance process efficiency.

2. **Big Data Analytics**

   Big Data Analytics can offer several ways for improving asset performance, streamlining manufacturing processes and facilitating product customization. Using Big Data Analytics enables Manufacturers to make informed decisions using productivity and waste performance data and lowering operating costs and increasing the overall yield.

3. **Artificial Intelligence (AI) and Machine Learning (ML)**

   For several decades, robotics and mechanization have been employed by manufacturers to increase productivity and minimize production costs per unit. Artificial Intelligence (AI) and Machine Learning (ML) seem to be the next wave in Manufacturing. AI is helping production teams analyse data and use the insights to replace inventory, reduce operational costs and offer seamless quality control over the entire manufacturing process.

4. **3-D Printing**

   The 3-D printing or additive layer manufacturing technology is set to make a huge impact on high-end industries such as aerospace, mining machinery, automobiles, firearms, commercial and service machinery, and

[21] https://www.reliableplant.com/Read/31161/technologies-impacting-manufacturers

other industrial equipment. This revolutionary technology allows manufacturers to create physical products from complex digital designs stored in 3-D Computer-aided Design (CAD) files.

5. **Virtual Reality**

Virtual reality (VR) is simplifying the product design process by eliminating the need to build complex prototypes. Designers and engineers are using VR to create realistic product models, allowing them to digitally see their designs and troubleshoot potential issues before starting production. Clients can also review and interact with these digital designs, simulations and integrated devices, significantly reducing the time needed for designing to manufacturing the finished product.

1.2.3 Implications for Skills Development

[22]The skills to respond to the technological change drivers above, and in short supply in the Manufacturing Sector are:

- Advanced Computer ICT Skills, i.e. Network Design and Software Development;
- Electrical engineering and mechatronic skills; and
- Data Analytics.

1.3 Financial, Business Services & Business Process Outsourcing (BPO) Sectors

The scope of Financial and Business Services is vast and includes BPO Services; Consulting Services; Customer Services; Human Resources Services; Cleaning; Patronage; Repair and Maintenance Services; Dispute Resolution and Prevention Services; It Services; Security Services; and Financial Services.[23]

Financial services include Accountancy; Banks and Building Societies; Real Estate; Stock Brokerages; Tax Services; Valuation; Risk management and Insurance.[24]

[22] MerSETA SSP, 2020-2025, and FP&M SSP, 2020-2022
[23] Western Cape Digital Skills Shared Agenda, Western Cape Digital Skills Shared Agenda, Craffert and Visser, 2019
[24] Western Cape Digital Skills Shared Agenda, Western Cape Digital Skills Shared Agenda, Craffert and Visser, 2019

The section below will outline Digital Transformation in the Financial and Accountancy Services Sector (FAS); BPO Sector; Banking Sector; and the Insurance Sector.

1.3.1 Financial and Accountancy Services Sector

1.3.1.1 Sector Profile

The Financial and Accounting Services (FAS) Sector in South Africa falls within the broader '*Finance, Real Estate and Business Services*' sector, as defined by Statistics South Africa.

The organisations belonging to the sector can be clustered into seven sub-sectors viz.:

- Investment Entities & Trusts & Company Secretary Services;
- Stockbroking and Financial Markets;
- Development Organisations;
- Accounting, Bookkeeping, Auditing & Tax Services;
- Activities Auxiliary to Financial Intermediary;
- Business & Management Consulting Services; and
- SARS & Government Departments.

1.3.1.2 Key Drivers and Technological Change

Following the COVID-19 pandemic, the FAS sector needed to invest in seamless organisational structures, increased technological connectivity, to enable business continuity in the face of interruption. Many personnel across sub-sectors were not able to adapt to working from home, due to lack of tech savviness, and poor communication skills. This made client interactions difficult and slowed down business turnover.

In addition, the sector must adopt digital communication strategies, re-skill and upskill personnel, equip management with crisis management skills, and normalise virtual interaction such as Zoom, Skype and Microsoft Teams. Business in the sector will suffer without this adjustment. Clients' portfolios and investments still need to be managed, securely and with confidence, more so during a disrupted financial market.

[25]Furthermore, the accountancy profession will evolve significantly due to automation, AI, the Internet of Things (IoT), blockchain and cloud computing. The spread of digital technologies and its impact on business will transform the practise of accounting and the competencies that professional accountants require. The full integration of technology and 4IR systems will lessen human intervention over time for the financial and accounting services industries.

[26]There is a shortage of a set of digital professional skills to feed the demand of this sector. The shortages currently being experienced are as follows (Table 5)

Table 5: Occupational shortages in the FAS Sector, as expressed for 01 January-31 December 2020

Rank	FASSET Occupation Group	OFO Code	Occupation	Needed	Reasons
1	ICT Professionals	121905	Programme or Project Manager	15	Pool of sufficiently qualified and experienced candidates is very small in the local market
		133103	Data Management Manager	6	The Financial Sector Conduct Authority (FSCA) requires a new skill and expertise to address its expanded mandate
		133105	Information Technology Manager	8	Geographical; not enough African Black; lack of experienced and qualified candidates
		243403	Computer Consultant	2 028	Limited number of individuals with experience in required systems and complex payrolls; lack of EE candidates
		251101	ICT Systems Analyst	38	Absolute scarcity; lack of EE candidates; lack of financial services experience
		251201	Software Developer	102	Lack of specialised experience within FAS; inexperienced SQL Developers; remuneration; difficult to retain and attract
		251202	Programmer Analyst	2 073	Lack of required qualifications in sector; scarcity of EE candidates with relevant experience (15+ years exp required); extensive architectural implementation experience needed which graduates lack
		251203	Developer Programmer	41	Lack of relevant qualifications and experience
		251401	Applications Programmer	5	Shortage of developers in market; inexperienced SQL Testers; EE lack
		252101	Database Designer and Administrator	2 072	Lack of EE candidates; lack of exceptional mathematical and creative abilities; inadequate number of graduates with necessary Engineering/Business Mathematics/Informatics skills; not enough specialists in SA, new industry
		252301	Computer Network and Systems Engineer	28	Not enough specialists in SA; limited number of people with certifications
		252901	ICT Security Specialist	65	Lack of suitable candidates with required experience and qualifications, affordability
		214101	Industrial Engineer	6	Relative scarcity; lack of experience
Total needed				6 487	

Source: FASSET Sector Skills Plan, 2020 – 2022

[25] Jooste, 2019

[26] FASSET SSP, 2020-2022

1.3.1.3 Implications for Skills Development

Most key trends driving this sector growth relate to digital skills, which will be even more true postCOVID-19, as workplaces and work operations go increasingly more digital. The Financial Services Sector has an especially strong demand for Information and Communication Technology (ICT) skills.

Targeted training for employees will be important to maintain relevancy in an increasingly globalised environment and the advent of the 4IR. Employers in the industry must embrace advanced technology to maximise its potential for faster operations and increased productivity in the sector.

1.3.2 Business Process Outsourcing (also known as Business Process Services) Sector

1.3.2.1 Sector Profile

[27]Over the past twenty years, businesses around the world have been using outsourcing and shared services to improve service delivery and reduce costs within defined parts of their businesses, traditionally known as Business Process Outsourcing **(BPO)** and Business Process Services **(BPS)**.

The BPS operators deliver a range of services for their local and global clients including contact centre services; finance and accounting services; legal services; information technology services; education services; Human Resources services; and knowledge services, while captive operators provide shared services to their corporate divisions and business units.[28]

1.3.2.2 Key Drivers and Technological Change

In the macro environment, digitalisation in the workplace has had a significant impact on current and future skills we need to develop. By its nature, offshore operations work remotely and require technology, processes and people to work in synchronicity.

[27] Global Business Services Sector Skills Strategy, 2019

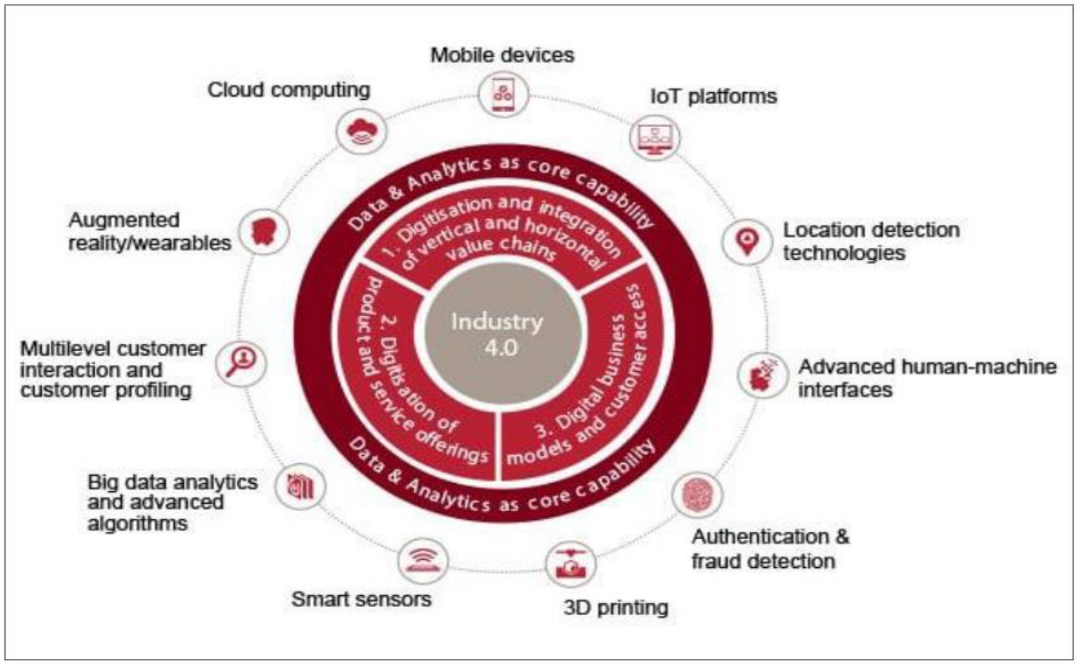
[28] Global Business Services Sector Skills Strategy, 2019

Client and service delivery diversity is also increasing, and this is evident in servicing an expanding network of countries requiring knowledge of country culture and customer segments.

Digitisation has also increased enterprise risk including the risk of data theft, hacking, fraud and even sabotage, thus cybersecurity is a prerequisite and an enabler for Industry 4.0. In addition, the integration of omni-channel capabilities require new skills sets and it is now recognised that voice alone is no longer enough to attract new Foreign Direct Investment (FDI). South African contact centres are evolving to engage customers through voice, email, chat, social media and self-service.[29]

Industry 4.0 encompasses end-to-end digitisation and data integration of the value chain: offering digital products and services, operating connected physical and virtual assets, transforming and integrating all operations and internal activities, building partnerships and optimising customer-facing activities.[30] Industry 4.0 creates the digital enterprise comprising of digitised and integrated processes, products and business models (Figure 17).

Figure 17: Industry 4.0 Digital Enterprise



Source: PwC Global Industry 4.0 Survey, 2016

[29] BPESA BPS Key Indicator Report, 2018

[30] PwC, Global Digital Operations 2018 Survey

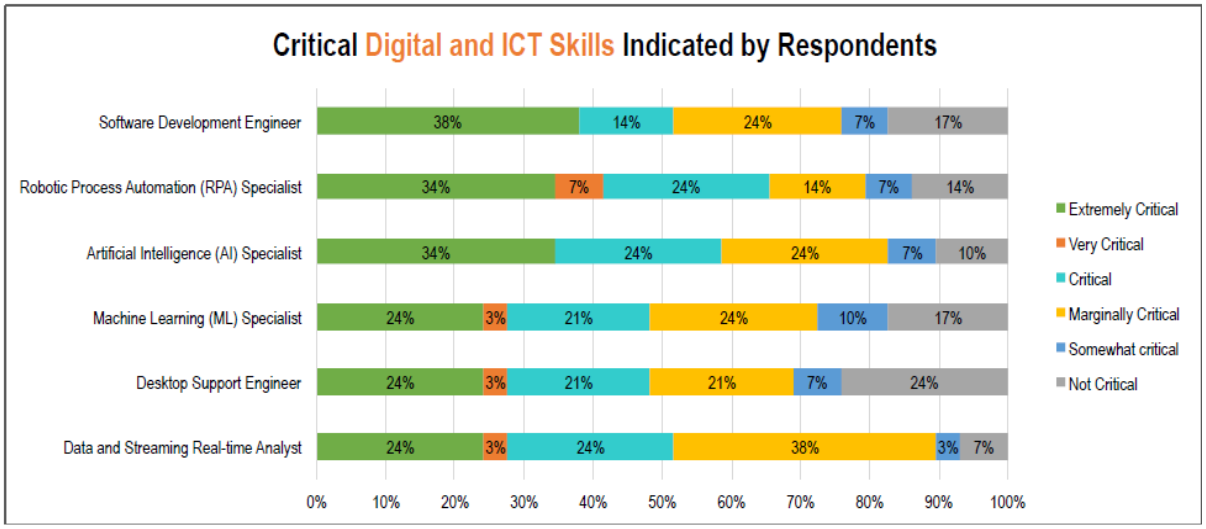
1.3.2.3 Implications for Skills Development

[31]According to Deloitte, different Information Technology (IT) skill sets and better skills blend and realignment of skills are necessary. A major challenge for South Africa is also the fact that there is not only a local, but also a global talent shortage for Industry 4.0 professionals. An extensive need exists to re-skill the existing workforce and/or upskill labour to understand and operate new and smart technologies.

[32]The top critical Digital and ICT roles identified, in order of rank, are:

1. Robotic Process Automation (RPA) Specialist;
2. Artificial Intelligence (AI) Specialist;
3. Software Development Engineer;
4. Data Streaming Real-Time Analyst;
5. Machine Learning (ML) Specialist; and
6. Desktop Support Engineer.

Figure 18: Critical Digital and ICT Roles



Source: Global Business Services Sector Skills Strategy, 2019

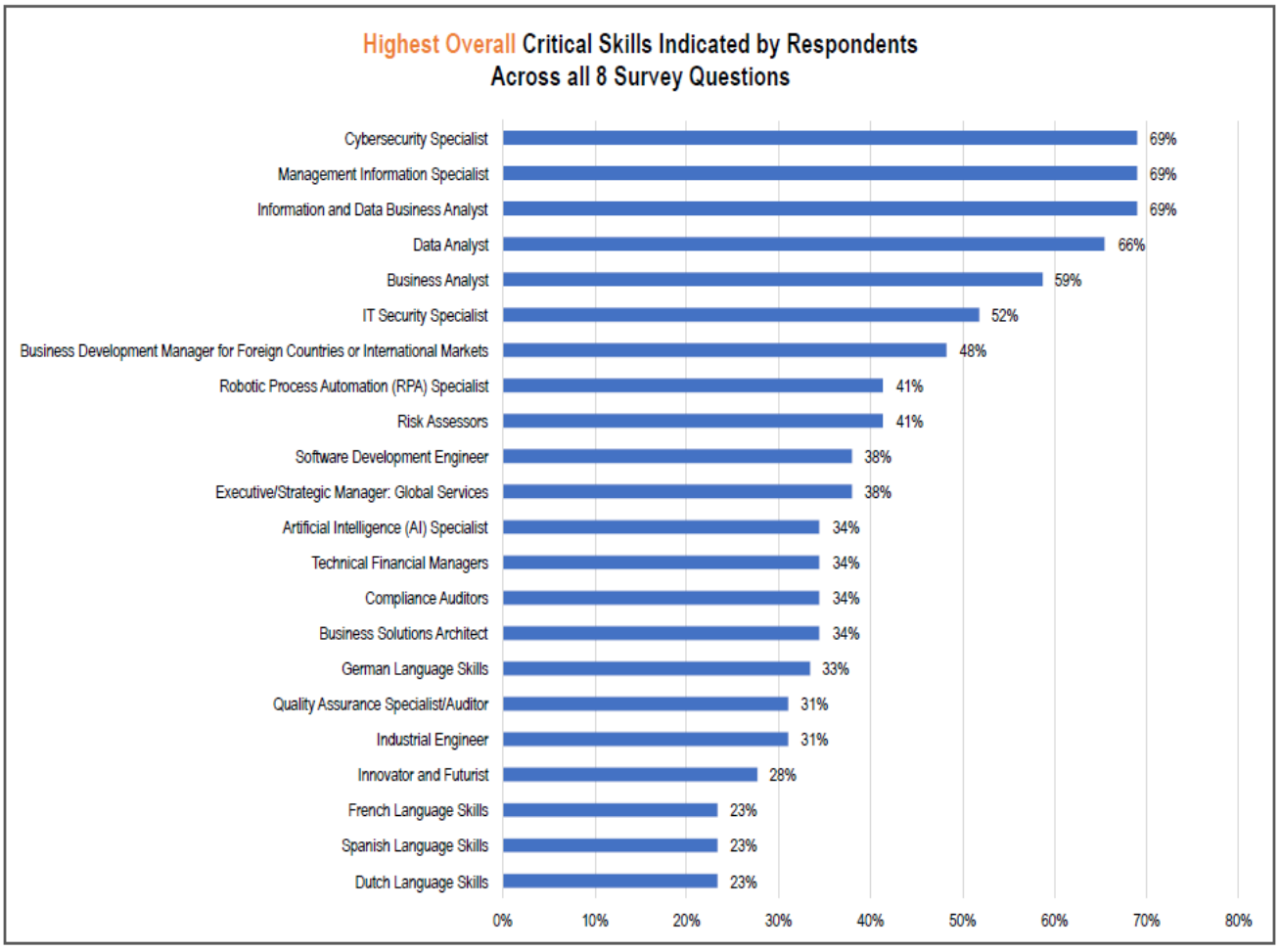
[31] Deloitte: Industry 4.0. Is Africa ready for digital transformation?

[32] Global Business Services Sector Skills Strategy, 2019

[33]The top ten highest critical skills identified for all roles, in their order of rank are:

1. Cybersecurity Specialist;
2. Management Information Specialist;
3. Information and Data Business Analyst;
4. Data Analyst;
5. Business Analyst;
6. IT Security Specialist;
7. Business Development Manager for Foreign Markets;
8. Robotic Process Automation (RPA) Specialist;
9. Risk Assessors; and
10. Software Developer Engineer.

Figure 19: Highest overall critical skills



Source: Global Business Services Sector Skills Strategy, 2019

[33] Global Business Services Sector Skills Strategy, 2019

[34]Cape Town is currently the most mature location in South Africa for GBS characterised by sizeable and skilled talent pool and world class business infrastructure. However, Johannesburg is increasingly becoming a new hub for international GBS delivery, driven by a large and accessible talent pool and substantial investment in digital skills.

1.3.3 Banking Sector

1.3.3.1 Sector Profile

Banking constitutes a key component of the Financial Services system and the economy. The Banking system is a key driver of the South African economy as it facilitates the liquidity (amount of capital available for investment and spending) required by households and firms for consumption and future investment. The credit and loans extended by financial institutions to the economy imply that households do not have to save up to make large purchases, while companies can also start hiring and making capital expenditure now, in anticipation of future demand and expansion.[35]

1.3.3.2 Key Drivers and Technological Change

Banking is undergoing a transformation from being based in physical branches to using Information Technology (IT) and Big Data, together with highly specialised human capital. Even before this transformation began, banks and markets had become intertwined, with a higher proportion of intermediary activities becoming market based. Banks face greater competition from other intermediaries, increasingly digital, in their core businesses, such as payment and advisory services.[36]

A change in the use of technology in developing new services and business models has been unfolding with the rise of the FinTech sector, which can be understood as the use of innovative information and automation technology in financial services. Cloud computing can reduce costs and promote low-cost innovation. Some advances disrupt banking in a big way, like crypto-currency, which skips banks in the payment process. The four technological advances

[34] Global Business Services Sector Skills Strategy, 2019
[35] BankSETA SSP, 2020-2025
[36] OECD (2020), Digital Disruption in Banking and its Impact on Competition

that are changing the face of banking, for better or for worse are social media, mobile banking, cloud technology and crypto-currency.

1.3.3.3 Implications for Skills Development

Digital disruption in the banking industry have serious implications for the demand of skills. With changes in business processes brought about by technology, a response to the provision of skills to serve these changes must also be devised in the following highly sought occupations in the Sector[37] :

- Analysts;
- IT System Architects;
- Software Developers;
- Network Specialists;
- Data Scientists and Data Engineers; and
- Robotic Engineers and Technicians.

The drivers of change are mostly related to digitisation and technological advancements. The change drivers listed above indicates that a change in the occupational landscape is emerging. Many new occupations with a strong technological flair like data management, data analytics and data scientists are emerging in the sector. In addition, the soft skills required are changing to include skills like agility, innovation, creativity, problem-solving, etc. Career fit seems to be the focus in terms of the skills needed in the banking sector where reskilling and upskilling for new job roles is currently underway.

1.4 Insurance Sector

1.4.1 Sector Profile

[38]The sector has professional bodies, industry associations, financial service companies, trade unions and regulatory bodies that support an insurance sub-sector, professionals, and employers. The sector is dived into the following sub-sectors: Unit Trusts; Risk Management; Insurance and Pension Funding; Life Insurance; Health Care Benefits; Short-Term Insurance; Funeral Insurance; Re-Insurance and Auxiliary Activities (includes brokers and intermediaries).

[37] Bank SETA SSP, 2020-2025

[38] InSETA SSP

The activities in the sector can be divided into three major categories, namely:

Table 6: Sector activities

Long-Term Insurance	This covers life-changing events, such as death, retirement and disability. The types of cover offered include life, disability, dread disease, funeral and credit life cover.
Short-Term Insurance	This encompasses all types of insurance policies other than life insurance. It includes vehicle, property, household, medical, personal liability, travel and business insurance.
Collective Investments	A collective investment scheme involves members of the public investing in a portfolio. This category was formerly known as unit trusts.

1.4.2 Key Drivers and Technological Change

i. Technology

This disruption involves the application of artificial intelligence, robotics, big data, digitisation, digital marketing, blockchain, predictive analytics and machine learning. Clients wants seamless, quick and transparent interactions, and this requires a new kind of marketer (salesperson) that it is tech-savvy.

Online social networking has emerged as an active component of social interaction. Financial institutions are looking to gain a competitive advantage while also trying to mitigate the threats posed by social media. Many companies are now using social media to revolutionise the traditional business models.

New Fin-Tech start-ups are popping up at an increasing pace, and large banks and insurance companies are being pushed toward increasing digital operations to survive. Insurers find it challenging to hire specialist IT experts, data scientists and actuarial talent.

ii. Product Development

Most insurers are struggling with innovative product development. They are working with constraining regulatory oversight, siloed business lines, legacy technology, and long-established processes and culture.

This challenge will be exacerbated by rapid, fundamental changes in society, the economy, and technology. The sharing and gig economies could fuel rising expectations for enhanced customer experience based on convenience and customisation while blurring the boundaries of commercial and personal insurance lines as well as undermining the relevance of many standard coverages. Several InsurTechs are already engaging in real-time coverage., i.e. insurance agencies using an application that enables consumers to insure single items such as cameras and digital devices with coverage that can be activated and terminated at any time over a mobile app.

iii. Future Work

Robotic process automation and artificial intelligence that can automate manual tasks are rapidly infiltrating the sector, remaking or eliminating jobs that are labour intensive. The time and attention of actuaries, underwriters, claims adjusters and other key players will likely be freed up for higher-level tasks.

1.4.3 Implications for Skills Development

The following skills gaps within the various roles have been identified as follows:

Table 7: Skills Gaps within Roles in the Sector

MAJOR OCCUPATIONAL GROUP	TYPES OF SKILLS GAPS	
Managers	Legal governance & risk Management & leadership Marketing & sales Planning & organising Problem-solving	Project management Strategic thinking Interpersonal Financial Mentoring and coaching Negotiation
Professionals	Advanced IT & Software Communication (oral & written) Interpersonal Financial Legal governance & risk	Management & leadership Marketing & sales Planning & organising Problem-solving Mentoring and coaching Tax
Technicians	Advanced IT Communication (oral & written) Interpersonal	Legal governance & risk Supervisory
Clerical and Administrative Workers	IT Communication (oral & written) Interpersonal	Legal governance & risk Supervisory Administration
Sales Workers	Marketing and sales IT	Communication (oral & written) Interpersonal
Elementary Workers	Basic IT Communication (oral & written)	Interpersonal

Source: InSETA SSP, 2020-2025

It is clearly demonstrated above that the Advanced I.T is a common skills gap in all roles within the Sector. Similarly, Table 8 below demonstrate the skills gaps by Occupation.

Table 8: Skills Gaps by Occupation

MAJOR OCCUPATIONAL GROUP	TYPES OF SKILLS GAPS
Insurance Agent (332101)	Insurance Sales meet fit and proper requirements (FAIS compliant); Personal, Commercial and Technical ; Medical Underwriting.
Insurance Broker (332102)	Building and maintaining business relationships with clients; discussing and assessing clients' current and future insurance needs; researching insurance policies and products; negotiating policy terms and costs with insurance providers; marketing and sales.
Actuary (212101)	Actuarial Analyst; Actuarial Assurance Specialist; Actuarial Consultant; Actuarial Manager; Group Benefits Actuarial Managers; and Management Professionals Moses testing; VBA; C++; Actuarial studies and exams; IT skills & programming; risk calculation; unique business need Consultant: Regulator Co-ordination & Advanced Analytics
Data Analyst (No OFO code)	Mathematical ability; programming languages, such as SQL, Oracle and Python; ability to analyse, model and interpret data; problem-solving skills.; and accuracy and attention to detail.
Insurance Loss Adjustor (331503)	Claims Adjuster experience; liability; investigating; communication Skills; customer Service; written Communication; Claim Handling; and estimating.
Financial Investment Advisor (241301)	Financial plans for individuals and organisations; investment strategies and taxation; securities, insurance, pension plans and real estate Investment Analyst Portfolio Manager Retail Implementation and Private Wealth
Fraud Examiner (242215)	Data analysis, deductive reasoning, search, analysing financial information, collecting evidence and interviewing witnesses and suspects.
Developer Programmer (251203)	Analyst Developer; Application Architect; Senior Developer (.Net); System Developer and Technical Developer Write programs in a variety of computer languages, viz. C++; Java Update; debug programs through testing and fixing errors; build and use computer-assisted software.
ICT Security Specialist	Intrusion detection, malware analysis and reversing, programming know-how, risk analysis and mitigation, cloud security, security analysis.
Organisational Risk Manager	Analytical skills and have an eye for detail Along with the ability to understand broad business issues Other skills are corporate governance; enterprise risk management; information and security risk; market and credit risk; regulatory risk; operational and technology risk; business continuity management.

Source: InSETA SSP, 2020-2025

When reviewing tables 7 & 8 above, it is apparent that both basic and advanced technical skills are required within the Insurance Sector, and that skills interventions planned must focus on both aspects to ensure that the growth of the Sector is not hindered.

1.5 Tourism Sector

1.5.1 Sector Profile

[39]The UNWTO(United Nations World Tourism Organization) 2018, Tourism Highlights 2018 Edition defines Tourism as "*…the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes.*" It embraces the tourism value chain which includes international tour agents and operators (inbound and outbound), accommodation establishments, air and ground transport and a myriad of local enterprises from local operators to tour guides; restaurants; curios; natural attractions; conferences and many more.

1.5.2 Key Drivers and Technological Change

Tourism was one of the first sectors to digitalize business processes on a global scale, bringing flight and hotel booking online to become a digital pioneer. As ICT became a global phenomenon, tourism was a consistent early adopter of new technologies and platforms.

Technology continues to assimilate into the lives of people. It, therefore, comes as no surprise that technology is increasingly being used by travellers to engage tourism products and services, which may have an impact on the skills required by these tourist product and service owners:

i. **Time Poverty** – is defined by people having to do more and with less time to do it in, will affect every travel segment. Time poverty drives the need to access information faster, with less effort and at convenient times. This has led to consumers using the internet to search for the best holiday options based on their personal needs.

ii. **Convenience Booking** – Viewing all available options were cited as a major influence, enabling the client to find and book the best property and price for their trip. Technology has created seamless customer booking experiences and comprehensive research tools, resulting in the culture of convenience booking.

[39] Tourism and Hospitality Sector Skills Framework for City of Cape Town, Draft Report, June 2020

iii. **Instant Consumption** – Travellers had become impatient with the process of "*finding the good stuff*." From preferred restaurants, to lodging, to things to see and do, travellers report frustration with having to dig through tons of brochures, websites, etc. to find travel choices. They want someone or something that gives them instant and easy information. Online concierge services are proliferating as consumers seek easier trip planning where planning services are provided.

iv. **Robots, chatbots and automation** – There is an increased use of robots, chatbots and automation within the travel industry. Examples include interactive robots to handle certain reception duties such as Connie, the Hilton Hotel chain's robot concierge. Some hotels use robots to serve food and drink to visitors, while many consumers book their travel and accommodation with the help of internet chatbots, specifically tailored AI who can handle queries and assist customers with useful information when human operators are unavailable.

v. **Recognition Technology** - Recognition technology is becoming more important in the travel and tourism sector. Examples of its use include automatic gates at some borders that can read the data on the traveller's passport or ID card and matching it to their face using a camera and facial recognition technology. In hospitality, voice recognition is increasingly being used to control smart hotel rooms.

vi. **Artificial Intelligence (AI) and Machine Learning (ML)** – During the past decade, AI and ML have entrenched itself in the tourism industry where AI and ML are finding applications everywhere, from customer service to security. Examples of AI include its use in marketing and to assist consumers to personalise the experience of finding and booking tours and trips. AI is also used in smart hotel rooms, identifying the likely needs of guests and fine-tuning the environment and services to fit the guest's needs and preferences. Future AI tourism trends to watch out for might include self-driving vehicles and virtual guides for tourism.

vii. **Internet of things (IoT)** - IoT devices are gadgets equipped with a microprocessor and some form of digital connectivity, allowing them to connect to, and be controlled from the internet. Examples of IoT devices include heating and cooling systems, entertainment systems and other items often found in a hotel room, giving rise to "smart" hotel rooms. The IoT is also used to integrate services in a hospitality setting, for example by allowing guests to book activities (a session in the hotel's spa, swimming in the pool, training in the gym etc) or request such things as room service or extra linen via a hub or a smartphone application.

viii. **Virtual reality (VR)** – VR a combination of physical elements like controllers or movable seating and platforms to simulate a place or experience. The technology can be used to "visit" destinations that are too fragile for physical tours, such as archaeological sites or to promote a tourist attraction, activity, or event.

ix. **Augmented reality (AR)** – AR real-world experiences and virtual elements. Examples of AR include AR smartphone apps that show tourists information about the area they are exploring such as historical details about buildings and landmarks, or listings and menus for entertainment venues and local eateries. Museums make increasing use of AR, allowing visitors to view artefacts with their original appearance as a virtual overlay. Other augmented reality applications might include internet-enabled virtual maps.

x. **Smart travel facilitation**

In the same way the smartphone has transformed telecommunications and media, a comprehensive smart travel model – one that includes smart visas, borders, security processes and infrastructure – will revolutionize tourism. With consolidation of these tools, passengers can book their flights and check in online, have their boarding passes on their smartphones, go through automated clearance gates and even validate their boarding passes electronically to board planes. These measures improve both travel facilitation and security.

1.5.3 Implications for Skills Development

Technical professions include architects, website designers and computer software designers. They need to have in-depth theoretical knowledge of different access requirements and barriers to accessibility. However, they will also need to have in-depth knowledge of assistive technology, service animals and people using personal support to develop appropriate measures for access requirements. Table 8 shows a list of technical professionals and their skill needs mapping their skill needs, while Table 9 map their skill needs.

Table 9: Technical Professionals skills needs

Technical Professionals				**(ISCO 2161) Building architects (ISCO 2166) Website designer (ISCO 2512) Computer software designer (ISCO 2513) Web and multimedia developers**			
Level of Training				Training types			
	Comprehension and awareness of accessibility			Hands-on skills to overcome practical obstacles			
	Knowledge of definition of disabilities/types of disability/ access req's.	Barriers to accessibility & Design for All	Strategic development of accessibility in business	Principles of effective customer service	Proper etiquette for dealing with PwD	Recognising and responding appropriately to people using personal supports	Service animals and assistive technology
Introductory level			n/a	n/a	n/a		
In-depth level	x	x				x	x

SOURCE: EUROPEAN COMMISSION. MAPPING SKILLS AND TRAINING NEEDS TO IMPROVE ACCESSIBILITY IN TOURISM SERVICES.

Trends show the increasing need for digital savvy employees, which will be even more so during the COVID-19 pandemic where Tourism companies must mostly pause operations and focus on marketing for when the Industry re-opens. However, currently there is little formal training for digital skills in Tourism.

A digitalized tourism sector must innovate and generate new business opportunities to ensure the continued competitiveness, growth and sustainable development of the sector.

1.6 Wholesale and Retail Sector

1.6.1 Sector Profile

[40]The retail sector involves and sale and exchange of goods directly to consumers whereas wholesale involves sales from wholesalers to retailers. The

[40] Western Cape Digital Skills Shared Agenda for Action - As-Is Landscape, Leona Craffert and Kobus Visser, 2019

following key sub-sectors have been identified by stakeholders within the retail and wholesale sector, namely Clothing, Supermarket, Motor trade and fuel, e-Retailing, Jewellery, Hardware, Merchandising[41].

General dealers dominate the sector, making up 42% of all retail enterprises. This is followed by textiles, clothing, footwear and leather goods retailers that comprise 20% of the retail sector. Wholesalers of solid, liquid & gaseous fuels & related products dominate the sector followed by food, beverages & tobacco and machinery & equipment and supplies wholesalers[42].

1.6.2 Key Drivers and Technological Change

Digital is having an impact on every part of the Retail and Wholesale sector value chain, creating opportunities for new market creation, market entry and innovation. It is driving new capabilities and ways of operating, challenging traditional business models and transforming the traditional competitive landscape. Omni-channel marketing is now the norm for most brands and includes web, social, email, mobile app and traditional brick and mortar shops. The integration and orchestration of these comprise what is known as the "*customer journey*".

Digital reach of this sector has become increasingly important in the face of COVID-19 pandemic and its economic, social and spatial restrictions. Some of South Africa's biggest e-Commerce platforms are based in the Western Cape, including giants like Spree, Gumtree and Zando, with 18,4 million e-Commerce users in South Africa, prior to COVID-19.

When it comes to e-Commerce, customer expectations were already rising pre-COVID-19, as "*the digitalisation of all facets of the value chain is enabling very high levels of tracking, personalisation, customisation and engagement*." Craffert and Visser believe there is a need for significant up-skilling and re-skilling in the Western Cape Retail and Wholesale workforce, including at leadership skills, high-level sales skills and most importantly, digital entrepreneurship skills. This is even more true considering the COVID-19 pandemic.

[41] Western Cape Digital Skills Shared Agenda – As-Is Landscape, Craffert and Visser, 2019
[42] Western Cape Digital Skills Shared Agenda As-Is Landscape, Craffert and Visser, 2019

The trends disrupting the wholesale and retail sector are presented in Table 10.

Table 10: Trends disrupting the Retail sector

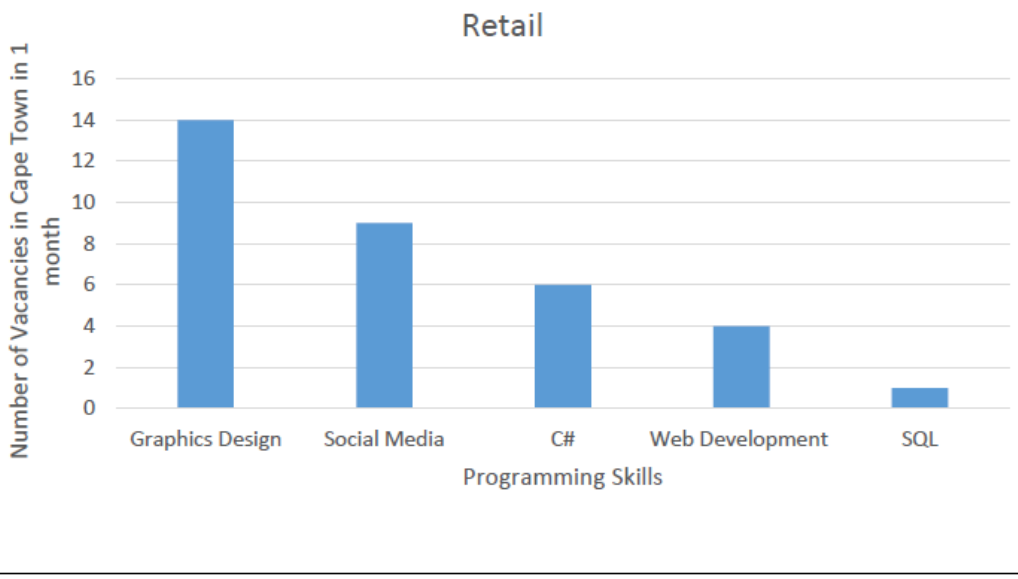
Customer experience & value propositions	· Better understand customer behaviour through data & analytics, and so personalise services & offers · Improved in-store experiences · Increased e-commerce · Personalisation of the service experience · More payment options enabling easier transactions · Ability to service global customers through e-commerce
Optimisation of operations	· Quick response to fluctuations in demand to optimise inventory management · Ability to integrate products & service to create a valued experience · Business intelligence from analytics to improve display & distribution
Internet of Things	· Enhanced supply chain visibility leading to stock-out prevention etc. · Transparent supply chain enabling customers or wholesalers to track product flow · Connect infrastructure, stock and systems and for example create · Location based offers and service customisation alerts when a product needs to be re-ordered or has perished
Big data	· Merchandising and market analysis · Campaign management and customer loyalty programmes · Supply-chain management and analytics · Event and behaviour-based targeting · Market and consumer segmentations · Linking purchasing data, geo-location data with payment data through converged partnerships
Mobile connectivity	· Mobile point-of sales devices to improve payment process · Engagement of customers to provide detailed product information · Devices to assist with scanning and distribution of goods
Artificial intelligence	· Analytics & predictive models to help personalise experiences, enhance inventory demand visibility & forecasting · Automated packing and distribution of orders
Automation, Robotics & 3D Printing	· Various applications – drones to monitor stock levels, virtual assistants to place and receive orders, robotic product picking & packing · Partly 3D printed infrastructure and production equipment components · Automated inventory and warehouse management
Nature of work	· Improved employee productivity in digitally enabled environment · Ability to create more responsive retail working environment · Increased need for workers to become "digital operators" using digital tools in the delivery of products or services.
Source: BizzCommunity. 2018. [36]	

1.6.3 Implications for Skills Development

The top emerging digital skills needs in the sector are: programming skills for graphic designers, social media, dot.net developers, web developers and SQL programmers; Data analytics; Big Data; Cyber security; VR; and Cloud computing. It is therefore not surprising that data analytics emerges as the top digital skills need in the retail sector.

Table 11 below depicts the number of digital skills vacancies in the Retail Sector

Table 11: Retail vacancies



Source: Bizz Community (2018)[38]

It is clear skills development that significant up-skilling and re-skilling are required in the large Western Cape retail and wholesale workforce. This would take place on three levels[43]:

1) High levels of product information across channels, suppliers and distributors easily available on mobile will escalate the need for high level sales skills rather than basic product and price knowledge. This would, for example, mean that the sales person is familiar with the range and pricing of similar brands on the internet and is aware of what social media, blogs and celebrity tweets are saying about the product or brand.

2) All forms of buying and selling (Customer 2 Customer (C2C); Business 2 Consumer (B2C); informal and micro businesses) would rely on platforms (Gumtree, Facebook, Instagram) ultimately linked to mobile, mobile-based digital entrepreneurship skills are a universal need.

3) A process of "*downwards trickling*" of needs for digital skills is evident, where the most basic occupations now require digital literacy. These jobs are also most threatened by automation, robotics and integrated inventories and

[43] Western Cape Digital Skills Shared Agenda, Western Cape Digital Skills Shared Agenda, Craffert and Visser, 2019

supply chains. Even the job of the famous cashier at the checkout counter is likely to be supplanted. As thousands of jobs and livelihoods are at stake, a large-scale digital upskilling programme is indicated for the Western Cape.

1.7 Marine Manufacturing and Oceans Economy

1.7.1 Sector Profile

The Oceans Economy encompasses a sustainable economy for the ocean-based marine environment, related biodiversity, ecosystems, species and genetic resources including marine living organisms (from fish and algae, to micro-organisms) and natural resources in the seabed, while ensuring their sustainable use and hence, conservation[44].

Marine Manufacturing sector has been defined as comprising businesses predominately supplying shipbuilding; boatbuilding; and vessel repair and maintenance services[45].

1.7.2 Key Drivers and Technological Change

The landscape of Maritime is shifting with the rising tides of technology. The trends that are emerging are doing so out of necessity. Advances are all having monumental shifts in how the maritime industry are approaching new challenges and opportunities, which are:[46]

[47]Ship Automation Specialist

Totally Integrated Automation (TIA) and Totally Integrated Power (TIP)concepts not only reduce component life-cycle costs and increase levels of system reliability and safety, but also optimize the ship design, building and systems integration phases. Engineers, software developers and mechanics who can work on the new technology are already increasingly in demand.

[44] https://unctad.org/en/Pages/DITC/Trade-and-Environment/Oceans-Economy
[45] https://www.industry.gov.au
[46] https://www.seatrademaritimeevents.com/shiptech/en/reports-and-insights/eight-emerging-maritime-technologies.html
[47] *HTTPS://SAFETY4SEA.COM/CM-DRIVERS-OF-THE-4TH-INDUSTRIAL-REVOLUTION-IN-MARITIME-INDUSTRY/*

Cyber Security Specialist

The cyber security crisis is more rampant than ever, especially when it comes to maritime. Shipping companies hire persons responsible for designing, testing, implementing and monitoring security measures for their systems to prevent potential cyber-attacks.

3D Printing Technician

The 3D printing market is growing rapidly. Many projects have shown the potential of using 3D printing techniques to produce vessel components; think of the Wire Arc Additive Manufacturing (WAAM), the first 3D printed ship propeller. Thousands of new jobs are being created around the 3D printing industry as this technology gets evolved.

[48]Big Data and Analytics

IT infrastructure will be upgraded to retrieve, store, and process data in real time. Archived data can be stored either onboard a ship or onshore, thanks to the support of communication technologies. Furthermore, cognitive systems will act as data interpreters for humankind. These systems will combine machine learning and natural language processing to offer an intuitive interface between a person and a machine.

Robotics

There are three new types of robots that will be in use by 2030. The first will be a learning robot; the second will be a practical robot (one that can handle an asset); and the third type will be a mini-robot, useful for inspections in harsh, dangerous environments. This robotics will leverage: cognition; versatility; imitation; sense; and adaptability.

Sensors

The rate of application of sensors technology will rapidly increase and will raise a number of technological challenges. Devices will be able to oper-

[48] *https://www.seatrademaritimeevents.com/shiptech/en/reports-and-insights/eight-emerging-maritime-technologies.html*

ate in a network connected to a remote unit for data collection and processing. Wireless sensor technology and the development of a new generation of Micro- and Nano-mechanical sensors will be at the cusp of revolutionising environmental monitoring and data collection.[49]

Autonomous Ships

[50]The emergence of autonomous ships is also an important disruptive element for some industries. autonomous ships use a computer on board that takes decisions about the route, speed, fuel consumption, maintenance and even mooring in the harbour. They include Autonomous Underwater Vehicles (AUVs) and gliders with improved sensor platforms, which have progressed from niche status to an established part of operations in various marine sectors; in the oil and gas sector.[51] This technology is deployed in monitoring and inspection for leakages in underwater carbon capture facilities, as well as in the inspection of deep-sea pipelines[52].

Smart Ships

Smart ships are being widely debated as the shipping industry's next technological revolution. In the manufacturing industry, the term 'fourth industrial revolution' describes how 'smart devices' will replace the role of humans for the management, optimisation and control of machinery. In consumer technology, this is referred to as The Internet of Things: using sensors and digital technology, our personal habits are mapped and translated to automation for improving our daily lives.

In the Ocean Space sector, big data analytics, advanced materials, autonomous systems, sensors and communication, sustainable energy generation, carbon capture and storage, marine biotechnology and deep ocean mining are transformational in nature when used individually and when combined. These technologies will provide a deep understanding of the ocean space which may be used to help address the effects of climate change, the reduction of land-based resources, and the increasing population.

[49] RETHINKING INNOVATION FOR A SUSTAINABLE OCEAN ECONOMY © OECD 2019
[50] *RETHINKING INNOVATION FOR A SUSTAINABLE OCEAN* ECONOMY © OECD 2019
[51] Wilby, 2016
[52] Forshaw, 2018

Using these technologies, people living in coastal areas can be better protected from extreme natural forces such as hurricanes and tsunamis. They can also be used to protect the ocean environment from excess exploitation and misuse as we gain a deeper understanding of the impact of human activity on the geology, meteorology and ecology of the ocean space.

1.7.3 Implications for Skills Development

While new technology will create the demand for new skills, the smart ship efficiencies achieved may render some maritime professions obsolete, as with other technological evolutions. New skills are already being requested, mostly linked to data management and analysis. Other jobs linked to the engineering side of the technology to come will include: data grid engineer, remote automation engineer, engineering and naval crew, onboard support technician, shore support specialist or cyber-attack specialist.

1.8 Information Communication and Technology Sector

1.8.1 Sector Profile

There are many definitions for the ICT industry. The definition is directly dependent on the context in which ICT is used. For example, "*ICTs within the context of education encompasses not only a reference to equipment (i.e. devices) but also to a group of skills or competencies that teachers and students must possess in order to be considered having achieved a certain level of competencies as it relates to ICTs*". Zia, Ilahi and Khan define an ICT as "a diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information."[53]

1.8.2 Key Drivers and Technological Change

Vendors are currently promoting AI; Business Intelligence (BI); ML; Block chain; Big Data; IoT, Quantum computing; and many more new services

[53] Western Cape Digital Skills Shared Agenda, Western Cape Digital Skills Shared Agenda, Craffert and Visser, 2019

and products. These developments create a huge demand for the development of "*new*" skills, leading to enormous strain on the skills supply value chain. Educational and training institutions find it difficult to cope with fast-changing skills requirements and high demand for a skilled workforce.

Vendors, SMME's (i.e. niche companies, new technologies), and to a certain extent large companies are driving key changes in the industry. The key focus areas by vendors are presented in Table 12.

Table 12: Vendor focus areas

Vendor	Topics
Microsoft	Azure (Cloud Services: IaaS, PaaS, SaaS), Office365, Docker, Virtualization, DevOps, Cloud Development, Infrastructure as Code, Web Development, BI, Big Data (data analytics), AR/VR / Hololens, Blockchain, IoT (and data analytics), Cognitive Services
IBM	Cognitive & AI (Artificial Intelligence / Machine Learning / Cognitive Computing), Data Science & Analytics (big data and analytics), Blockchain, IoT, Quantum Computing and Algorithms, Security (IAM, Data Security, Cyber Security), Cloud development, Systems (mainframe development)
Oracle	Container Databases, In-Memory Grids, Blockchain, Data analytics/ BI / Ml, Java (monetize), Microservices, Architecture
SAP	SAP Hana (Cloud development), Machine Learning, Block Chain IoT, Intelligent Enterprise (Process Automation), Business Process Development

In addition to the above, Media, Information and Technology (MICT) SETA, identifies the following key change drivers in the 2020-2025 Sector Skills Plan:

- ✓ Cloud Computing;
- ✓ Internet of Things;
- ✓ Big Data Analytics;
- ✓ Information Security; and
- ✓ Artificial Intelligence and Robotics.

1.8.3 Implications for Skills Development

With the rapid changes in technologies, there is a need to develop the supply of skills to respond to this everchanging technological drivers.

The table 13 below depicts the hard to fill vacancies, as reported in the 2020-2025 MICT SETA Sector Skills Plan (SSP):

Table 13: Hard to fill Occupations by relative Demand and Contribution to 4IR

Occupation Code	Occupation	Quantity Needed	Relative Contribution to 4IR (ranked out of 15)	Relative Demand (ranked out of 15)
2017-251201	Software Developer	2434	7	3
2017-351301	Computer Network Technician	1948	8	12
2017-216603	Multimedia Designer	824	10	13
2017-251203	Developer Programmer	823	1	9
2017-252301	Computer Network and Systems Engineer	731	6	2
2017-252901	ICT Security Specialist	713	9	4
2017-251101	ICT Systems Analyst	676	11	5
2017-251202	Programmer Analyst	397	12	6
2017-242101	Management Consultant (Business Analyst)	359	4	11
2017-311401	Electronic Engineering Technician	276	14	8
2017-243101	Advertising Specialist	224	2	1
2017-215303	Telecommunications Network Engineer	164	5	10
2017-252101	Database Designers and Administrator	114	3	7
2017-214401	Mechanical Engineer	22	13	14
2017-215101	Electrical Design Engineer	19	15	15

Source: MICT SETA SSP, 2020-2025

Table 14 below demonstrates the hard to fill vacancies in the top 10 Occupations:

Table 14: ICT Occupations with hard to fill vacancies

Occupation	Reasons	Quantity Needed
2017-251201 - Software Developer	Lack of experienced candidates	2434
2017-351301 - Computer Network Technician	Lack of experienced candidates	1948
2017-251203 - Developer Programmer	Lack of experienced candidates	823
2017-351201 - ICT Communications Assistant	Lack of experienced candidates	755
2017-252301 - Computer Network and Systems Engineer	Lack of experienced candidates	731
2017-252901 - ICT Security Specialist	Lack of experienced candidates	713
2017-251101 - ICT Systems Analyst	Lack of experienced candidates	676
2017-351401 - Web Technician	Lack of experienced candidates	514
2017-252201 - Systems Administrator	Lack of experienced candidates	405
2017-251202 - Programmer Analyst	Lack of experienced candidates	397

It is generally accepted that there is world-wide shortage of people with the ICT skills necessary to boost the economies of the 21st century. e-Skills, as defined earlier, vary from low level, computer literacy skills needed by individual members of society to access services to high level technology skills needed by specialist

ICT professionals. A further important group of skills are those required by managers and leaders within non-ICT sectors of the economy that allow them to use ICT effectively and innovatively.[54]

[54] Challenges in Ascertaining ICT Skills Requirements in South Africa, December, 2010

Western Cape Government
Economic Development and Tourism

PART C

Academic Supply within the Western Cape

1 Digital transformation in Education and Training

1.1 Status of Digital Transformation in Schools in South Africa

The World Economic Forum (WEF) has highlighted the importance of South African educators to design future-ready curricula that accelerate the acquisition of digital and Science Technology Engineering & Mathematics (STEM) skills to match the way people will work. South Africa's government, with the help of private sector stakeholders, have an opportunity to develop tailored approaches to understanding the region's evolving skills base and emerging jobs scenarios. The need for schooling and re-schooling of the African labour force to find occupations less susceptible to automation, needs more recognition.[55]

The outbreak of COVID-19 came as a wake-up call to the education sector in South Africa, from primary, secondary and tertiary education. The crisis is exacerbating pre-existing education disparities by reducing the opportunities for many of the most vulnerable children, youth, and adults – those living in poor or rural areas, girls, refugees, persons with disabilities and forcibly displaced persons – to continue their learning. Most young people from disadvantaged backgrounds in South Africa continue to be denied access to information and communications technology because of poor infrastructure and the digital divide.[56]

The cost of mobile data is part of the problem. For example, compared with its fellow members of the Brazil Russia India China and South Africa (BRICS) group of nations, South Africa has the highest average price for 1GB of mobile data. One gigabyte of mobile data costs an average of US$1.01 in Brazil, $0.61 in China, $0.52 in Russia and $0.09 in India. It costs an average of $4.30 in South Africa. As a result, many young people in low-income communities don't have instant access to the internet.[57]

More than 80% of public schools are under-resourced. They are ill-equipped to respond to the teaching and learning challenges of the 21st century – let alone the latest demands of the COVID-19 pandemic. The COVID-19 lockdown imposed had suddenly compelled teachers to adopt predominantly online, blended learning

[55] Fryer, D (2020): BBrief: Digital transformation impact on businesses within South Africa
[56] Matli, W (2020):The Conversation: Young South Africans are shut out from work: they need a chance to get digital skills
[57] Matli, W (2020): The Conversation: Young South Africans are shut out from work: they need a chance to get digital skills

teaching practices. Nearly 90% of all households in South Africa are still without access to the internet at home. Very few schools had adapted to blended learning before lockdown and few schools would be able to adopt it during the lockdown. Therefore, the schools that had fewer resources and skills will fall even further behind.[58]

There are findings that in South Africa, during the COVID-19 pandemic lockdown, the Education Sector massively adopted different 4IR tools (digital transformation) from primary education to higher and tertiary education. The lockdown motivated the creation of virtual learning, the use of free zero-rated applications and educational websites, launching of STEM lockdown digital school and finally, the sector generally switched to remote learning (online learning). This suggest that during the lockdown, a variety of 4IR tools were unleashed from primary education to higher and tertiary education where educational activities switched to remote learning (online learning).[59]

The shift to online also means the digital divide in South Africa grow sharper unless it's possible to develop public-private partnerships to assist in closing the digital divide.[60] Furthermore, by making technology available to those who cannot afford it, and embracing it in the classroom, can help provide equal opportunities for all.

Investments in human development and digital skills are necessary to build a pipeline of future talent that can embrace this dynamic and increasingly digitised environment. This will require a massive educational overhaul that addresses basic education backlogs at all levels, from basic to tertiary education.[61]

Although the school closures initially caused disruption, over time they also prompted examples of educational innovation. There are signs suggesting that the crisis can have a lasting impact on the trajectory of learning innovation and digitisation. The WEF argues that the possible changes consist of three aspects:

[58] Oliver, W (2020): The Conversation: Education Post-COVID-19: Customised blended learning is urgently needed
[59] Mhlanga, D and Moloi, T (2020): COVID-19 and the Digital Transformation of Education: What We Are Learning in South Africa
[60] Mtshali, N (2020): The Conversation Africa: How Covid-19 could change the higher education sector permanently
[61] Fryer, D (2020): BBrief: Digital transformation impact on businesses within South Africa

1) The crisis could accelerate innovation within education. For those who do have access to the internet and the necessary technology, there is evidence that learning online can be more effective. With this insight and the experience gained during the crisis, new digital learning possibilities could be implemented by educational institution to stimulate productivity of the lessons. Potential innovations include educational applications, platforms and resources. All aiming to help parents, teachers, schools and school administrators to facilitate student learning, social care, and interactions during periods of school closure.

2) Public-private educational partnerships could grow in importance. The past decade showed increased interest from private companies in education. The pandemic could pave the way for large-scale, cross-industry cooperation around a common educational goal.

3) Given the digital divide, new shifts in education approaches could widen inequality. The quality of education depends on access to internet, the right technology, and the required skills to use it. As already mentioned, this differs heavily per country. The digital divide could worsen if the effectiveness of education is directly linked to access to the latest technologies.[62]

There is another school of thought that mentions that self-guided online learning is doomed to fail. Research shows an exceptionally high drop-out rate – even in developed countries. Learners simply have no incentive to keep at their studies without peer pressure, a teacher at hand or a structured learning environment. In South Africa in particular, with socio-economic disparities and related problems, the drop-out rate would be even higher. More so in key subjects like mathematics and physical science where prior knowledge, conceptual understanding and self-motivation to succeed are critical.[63]

The only answer, in the country's unequal teaching environment, is a customised version of blended learning. Blended learning integrates computer-assisted online activities with traditional face-to-face teaching (chalk-and-talk). When used by a trained teacher, this approach can add valuable new dimensions to the learning

[62] World Economic Forum (2020): 3 ways the coronavirus pandemic could reshape education
[63] Oliver, W (2020): The Conversation: Education Post-COVID-19: Customised blended learning is urgently needed

process. It can allow learners to work at their own pace and teachers to fill content gaps.[64]

1.2 Digital Transformation in Basic Education to the demands of a Digital Economy

1.2.1 Measures introduced on a National Level

In his state of the nation address in February 2019, President Cyril Ramaphosa stated that over the next 6 years, Government will provide every school child in South Africa with digital workbooks and textbooks on a tablet device[65]. The Department of Education would also expand the training of both educators and learners to '*respond to emerging technologies*' including the internet of things, robotics and artificial intelligence.

On top of coding and robotics, other new technology subjects and specialisations that will be introduced in schools include: Technical mathematics; Technical sciences; Maritime sciences; Aviation studies; Mining sciences; Aquaponics.

Following President Ramaphosa' s address, in March 2019, Angie Motshekga, the Minister of basic Education announced that Coding as a subject will be piloted at 1,000 schools across five provinces starting in the 2020 school year. The Department of Basic Education (DBE) partnered with the University of South Africa (UNISA) has partnered with the DBE by making available their 24 ICT Laboratories throughout the country for the training of 72,000 teachers in coding[66].

In addition, Google, Teen Geeks and other businesses are also supporting the DBE to develop a coding platform that uses AI and ML to customise teaching and learning. The Minister also announced that the DBE will be introducing a robotics curriculum from Grade R to Grade 9. The curriculum will have a strong foundation in engineering and will enable learners to build and operate robots through programming code, she said.

[64] Oliver, W (2020) The Conversation: Education Post-COVID-19: Customised blended learning is urgently needed

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

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

1.2.2 Measures introduced on a Provincial Level

The Western Cape Education Department (WCED) recognised that the infusion of ICTs in the educational space sets up a series of chain reactions. The most prevalent of these is the pervasiveness of the push-pull effects of education and technology. This requires a re-conceptualization of the use of technologies to support education. In response to this, they developed an e-Teaching and e-Learning Strategy based on the premise that education needed to structure systems and learning such that it supports the everchanging technological world its main and peripheral outcomes. Learners ought to exit a basic education system with relevant knowledge and skills, and be better prepared for higher education and the working environment, so that they may function as active citizens in the world that they find themselves in. For the changing world, this vison is called to be evolutionary[67].

WCED vision for digital transformation translated into 6 streams, namely:

1. e-Teaching – Teachers and education managers empowered to use technology effectively and innovatively.
2. e-Learning - Learners empowered to use technology effectively and innovatively.
3. Curriculum / Education – Models, methodologies, pedagogies and digital content responsive to educational needs.
4. Systems - Robust and reliable ICT systems that support e-learning.
5. Environment - A technology enriched environment (including ICT infrastructure) that enables effective learner-centred e-learning.
6. e-Administration – Robust and reliable ICT systems to reduce manual administration towards more effective and effective planning and management.

The WCED recognises that this vision will follow a phased implementation with a blended approach. Technologies will over time mature and whilst some will endure many will not keep pace with the educational pull. The consumers and users of these technologies will be the push factor that will drive the changes in technology innovations. Furthermore, there is a technological disconnect that appears to exist between teachers and learners and, between education and ICTs. It is recognised that through careful planning, this can be overcome through sound change management and e- Readiness programs[68].

[67] WCED vision for e-Education: e-Learning and e-Teaching in schools of the future, 2012

[68] WCED vision for e-Education: e-Learning and e-Teaching in schools of the future, 2012

There is a steady interest and supply of learners in the Further Education and Training (FET) band at schools in that have selected ICT, as well as Computer Application Technology (CAT) as a subject. This demonstrates a supply of technical skills on a basic level from one of the main-stream of academic supply in the Western Cape (Table 15 and Table 16)

Table 15: Students enrolled for Computer Application Technology at schools in the Western Cape during 2019

CAT (Computer Application Technology)

DISTRICT	ENTERED
CAPE WINELANDS	1270
EDEN & CENTRAL KAROO	937
METRO CENTRAL	863
METRO EAST	1566
METRO NORTH	2101
METRO SOUTH	808
OVERBERG	437
WEST COAST	552
TOTAL	**8534**

Source: WCED 2019

Table 16: Students enrolled for Information Technology at schools in the Western Cape during 2019

INFT (Information Technology)

DISTRICT	ENTERED
CAPE WINELANDS	72
EDEN & CENTRAL KAROO	28
METRO CENTRAL	152
METRO EAST	277
METRO NORTH	193
METRO SOUTH	169
OVERBERG	20
WEST COAST	9
TOTAL	**920**

Source: WCED 2019

WCED is cognisant that, given the realities of its current system such as: diverse schools; average age of teachers; levels of e-maturity; low literacy and numeracy levels; varying levels of technology management; budgetary constraints, etc., the implementation strategy will not necessarily be the same everywhere and at the same time.

1.3 Response of the Post-School Education and Training (PSET) Sector to digitization

The Institutions that will be referred to in the supply of relevant digital skills in the PSET Sector will be the Technical Vocational Education and Training (TVET) Institutions, Higher Education Institutions (HEI's – i.e. Universities), and the Sector Educational Training Authorities.

1.3.1 PSET Strategic Intent

The Department of Higher Education and Training (DHET), in their Strategic Plan, 2020-2025, undertakes to improve the quality of PSET provisioning by stating that Lecturers' pedagogical, curriculum development and research capacities will be improved, together with their abilities to harness digital technologies and a diverse range of methodologies to support teaching and learning in innovative ways. The development of digital pedagogies will be supported. In the next five years, various interventions specific to ensuring that the PSET system is responsive Introduce compulsory digital skills training specific to programme offerings at TVET colleges[69].

The establishment and operationalisation of Centres of Specialisation (CoS) in Technical and Vocational Education and Training (TVET) colleges is a critical project for which the DHET continues to engage employers to work with young people as apprentices. The project aims to provide fully qualified artisans for a range of sectors in the economy, including high-technology manufacturing, the creative industries, computer software and aerospace engineering[70].

[69] DHET Strategic Plan 2020-2025
[70] DHET Strategic Plan 2020-2025

1.4 Digital Transformation in the Technical Vocational Education Training (TVET) Colleges in South Africa

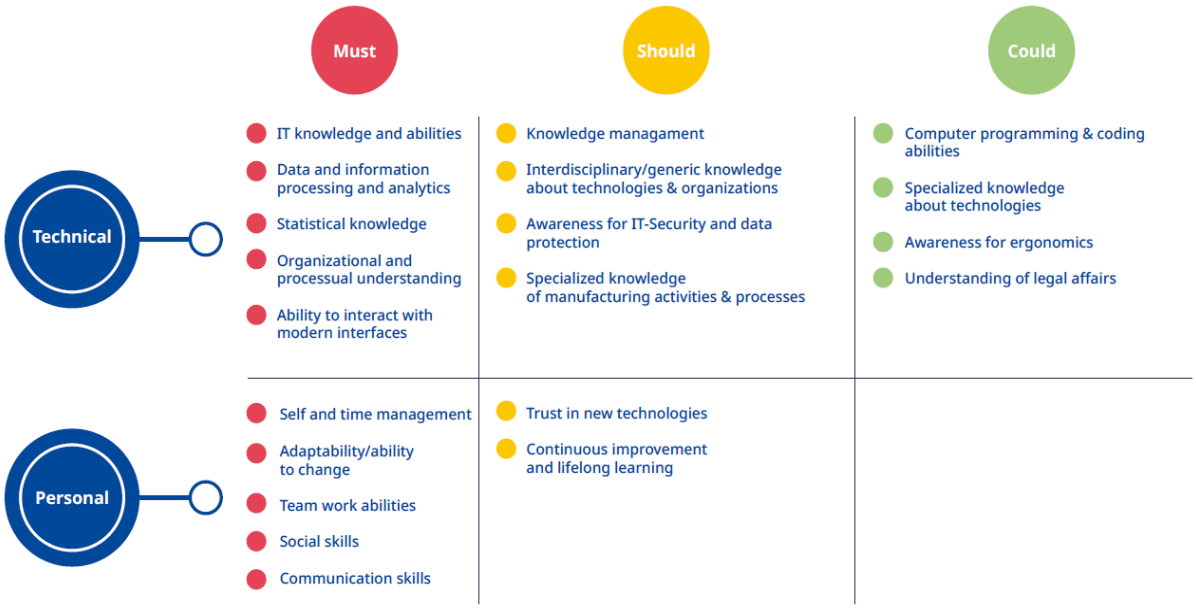
In South Africa, we will also see a growing "*missing middle*" cohort because of job losses. Providing financial support to these students is going to be more important now than ever.[71]

In technical and vocational education and training systems, vulnerabilities including low levels of digitalization and long-standing structural weaknesses, have been brought to light by the crisis. Disruptions in work places made it difficult to implement apprenticeship schemes and work-based learning modes, key elements of a functional and market-responsive technical and vocational system.[72]

A study emphasizes the need for a strong emphasis on digital skills at every level of TVET to facilitate (figure 20 and figure 21):[73]

- ✓ adaptation to workplaces where manual tasks are being taken over by digital tasks
- ✓ servicing digital workplaces, in terms of programming and engineering-related skills

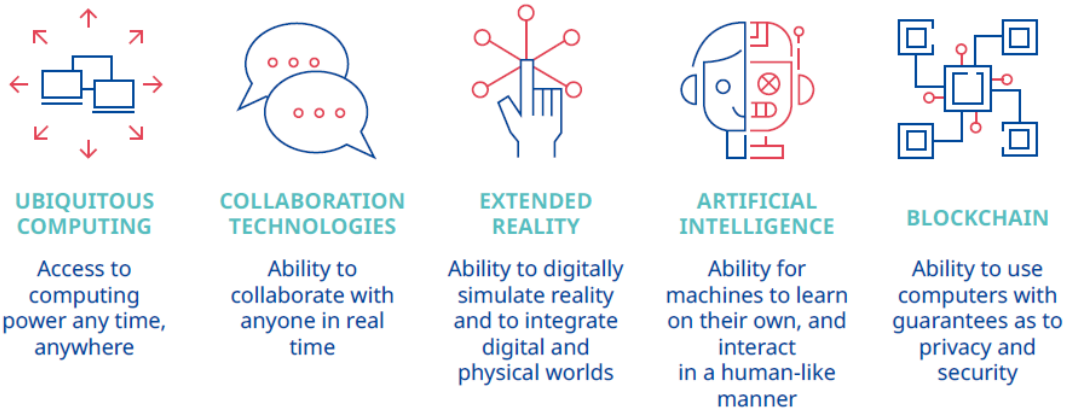
Figure 20: Future qualification and skills required from TVET



Source: ILO (2020)[74]

[71] Mtshali, N (2020): The Conversation Africa: How Covid-19 could change the higher education sector permanently
[72] United Nations (2020): Policy Brief: Education during COVID-19 and beyond- August 2020
[73] ILO (2020): The digitization of the TVET and Skills Systems
[74] ILO (2020): The digitization of the TVET and Skills Systems

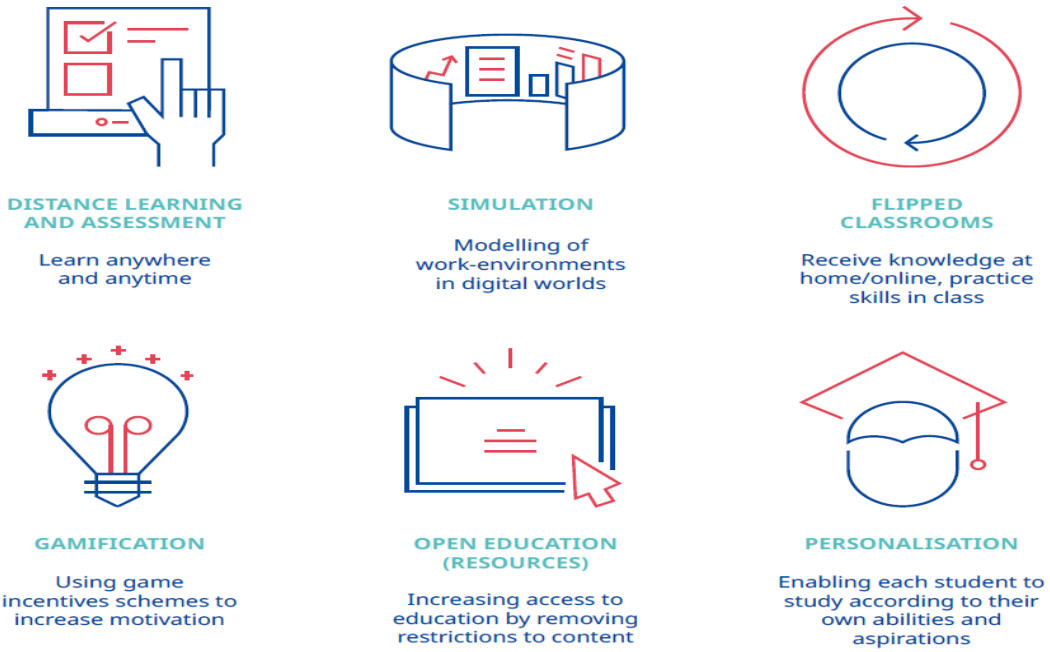
Figure 21: Five technologies driving digital transformation in TVET



Source: ILO (2020)

By inference or design, the affordances of technology in daily lives are also being explored as new modes of teaching and learning, both in and out of the classroom or training centre, with content delivered interactively and asynchronously, in a blended or totally online format. As an applied construct, technology at first glance also appears particularly suited to TVET transformation agendas (figure 22).[75]

Figure 22: Six areas of learning holding promise for TVET's



Source: ILO (2020)

[75] ILO (2020): The digitization of the TVET and Skills Systems

The Western Cape hosts six (6) Technical Vocational Education and Training (TVET) Colleges, namely: Boland College (BC); College of Cape Town (CoCT); False Bay College (FBC); Northlink College (NLC); South Cape College (SCC); and West Coast College (WCC).

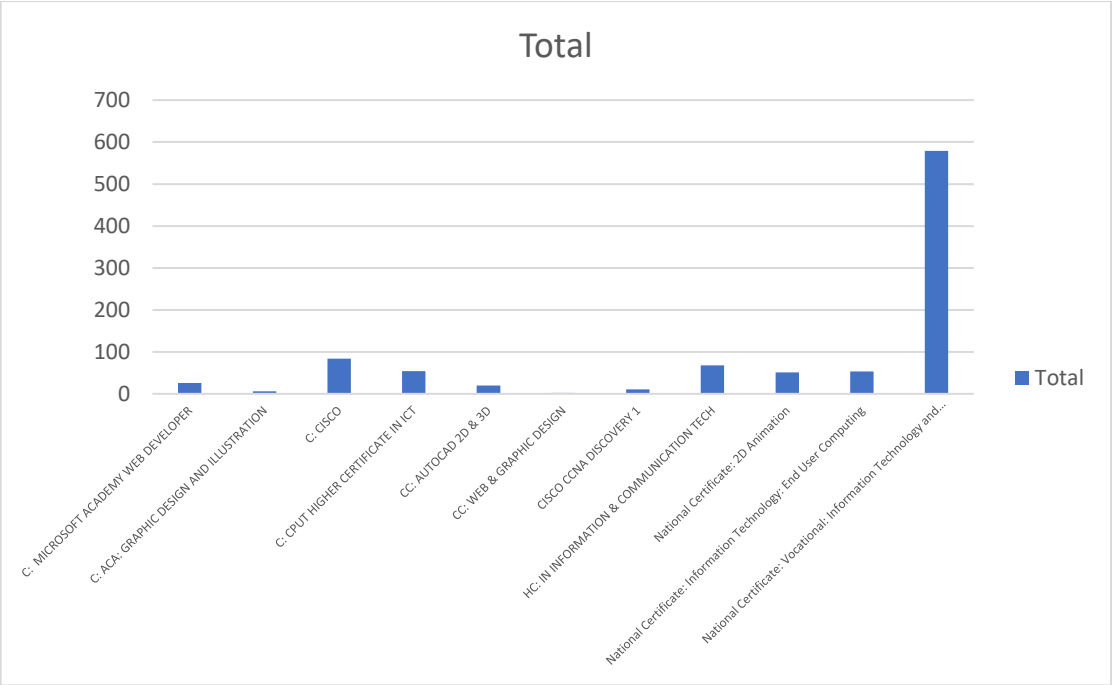
Desktop research was undertaken to determine the extent to which these 6 TVET Colleges in the Western Cape are addressing the need for digital transformation with the training programmes that they present. Unfortunately, this does not paint a positive picture, as:

- Only 4 out of the 6 TVET Colleges present the NC(V) Information Technology and Computer Science programme from Level 2-4 (BC; CoCT; FBC; and SCC).
- There are only 2 TVET Colleges (FBC and CoCT) that present the Higher Certificate in Information Technology Service Management Level 5.
- Only TVET College (NLC) presents specialised programmes such as IT: Technical and Network +, AutoCAD and IT: Graphic Design and Web Development.
- False Bay College presents training such as the National Certificate in 2D Animation Level 5.
- Cisco Network Associate programmes (CCNA) is presented by CoCT and FBC.
- WCC has no training programme (as per their website) that is directly linked to any ICT training programmes, but the college focuses more on the infrastructure part of ICT with their Electrical qualifications.
- Various short courses such as MS Word and Excel, Microsoft Office Specialist (MOS), Java Fundamentals, Web Design, IT Essentials.

It is concerning to note that the rural TVET Colleges have the least variety of training in the ICT field and this will exacerbate the digital divide between the urban and the rural spaces in the province. The programmes presented by the TVET Colleges are very limited and not cutting edge in innovation as this clearly indicates the disjunction between the skills supply and the skills demand in the digital economy.

The table 17 below represents the number of students at TVET Colleges within the Western Cape that registered for digital training skills courses in 2019.

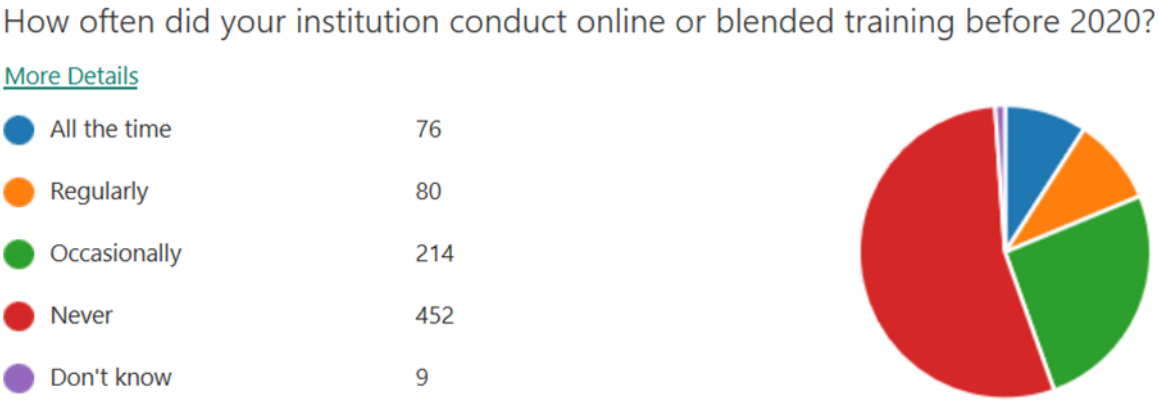
Table 17: TVET Learner Registrations in 2019



Source: TVETMIS 2019

The impact of COVID-19 on digitisation was not only felt by TVET Colleges, but also by the private providers that present Quality Council of Trade and Occupations (QCTO) qualifications. The QCTO did a survey with 831 to determine if they private providers are ready and prepared to do online training. The first question was to determine if the training providers did make use of any form of online training before the COVID-19 pandemic. More than half of the training providers indicated that they didn't make use of any form of blended learning before the pandemic.

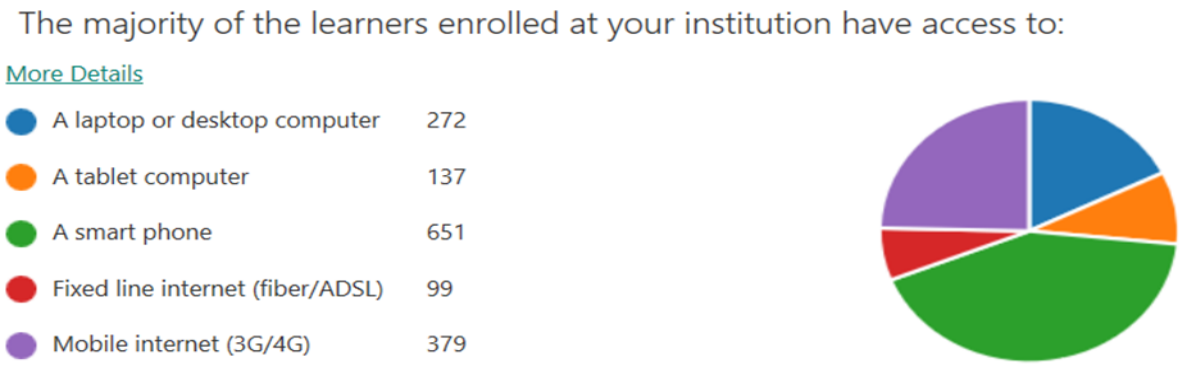
Figure 23: Number of online or blended training before 2020



Source: QCTO (2020)

Although many providers indicated that they are rapidly digitising training material and making it available online, it is worrying to see that a small number of the student population that is serviced by these training providers have access to a tablet, laptops or computers.

Figure 24: Access of learners enrolled at Institution



Source: QCTO (2020)

Most of the students have access to smartphones which indicates that whatever type of digitisation of material is taking place, it must be compatible with a smartphone. This might have an impact on the type of digitization of material that will have to happen, but if the above chart is evaluated, also raises the question of access the students have to the internet.

1.5 Status of Digital Transformation in Higher Education Institutions (HEI) in South Africa

Academic institutions have limited digital means (software and hardware) to enable quality education. At the same time, academic institutions, not just in South Africa, are still charging the same amount of money even though their offering has changed and diminished. While traditional institutions are offering less quality, tech companies are gearing themselves as providers of quality education.[76]

This is a situation that requires remodelling of education. Traditional universities are no longer viable places to offer education that will matter in the future. They also lack the necessary infrastructure to remain relevant during these tough times. Technology

[76] Diphoko, W (2020): IOL: Are universities becoming irrelevant? Tech firms take over in a Covid-19 world

companies are likely to replace them and that is fine in the short run – however, in the long run a different model of education will have to be developed.[77]

Google is offers vendor certified courses, such as Google Career Certificate, IT Support Professional Certificate and Data Analytics. The cost of these courses is quite low in relation to what universities charge. There's also no question that quality will be great judging by the Google products and the calibre of people who work at Google. What is even more important, which tends to be the measuring stick of importance for universities, the Google certificate comes with prestige that no university can match. Google has more legitimacy in providing education in data analytics, after all, its technology is responsible for collection and analysis of data[78].

This indicates the shift that is likely to happen in terms of who qualifies to offer education for some courses that will matter in the future. Traditional universities cannot legitimately offer the same course with the same depth as Google or another tech company with authority in the field being taught.

None of this suggests that a private tech company is best placed to offer education for society. The point is simply that they have better quality tools and know more about what will matter in the future than current institutions. It is therefore inevitable that tech companies are coming for higher education and there's little that academic institutions can do about it[79].

This is a situation that requires remodelling of education. Traditional universities are no longer viable places to offer education that will matter in the future. They also lack the necessary infrastructure to remain relevant during these tough times. Tech companies are likely to replace them and that is fine in the short run – however, in the long run a different model of education will have to be developed.

Some desktop research was undertaken to determine the ICT related training programmes that are presented by the 4 Higher Education Institutions (HEIs) in the Western Cape, namely:

1. The University of the Western Cape (UWC);
2. The University of Cape Town (UCT);

[77] Diphoko, W (2020): IOL: Are universities becoming irrelevant? Tech firms take over in a Covid-19 world
[78] Diphoko, W (2020): IOL: Are universities becoming irrelevant? Tech firms take over in a Covid-19 world
[79] Diphoko, W (2020): IOL: Are universities becoming irrelevant? Tech firms take over in a Covid-19 world

3. Stellenbosch University (SUN); and
4. Cape Peninsula University of Technology (CPUT)

All four the HEIs focus on ICT and ICT related training programmes in various disciplines. The following can be concluded from the research:

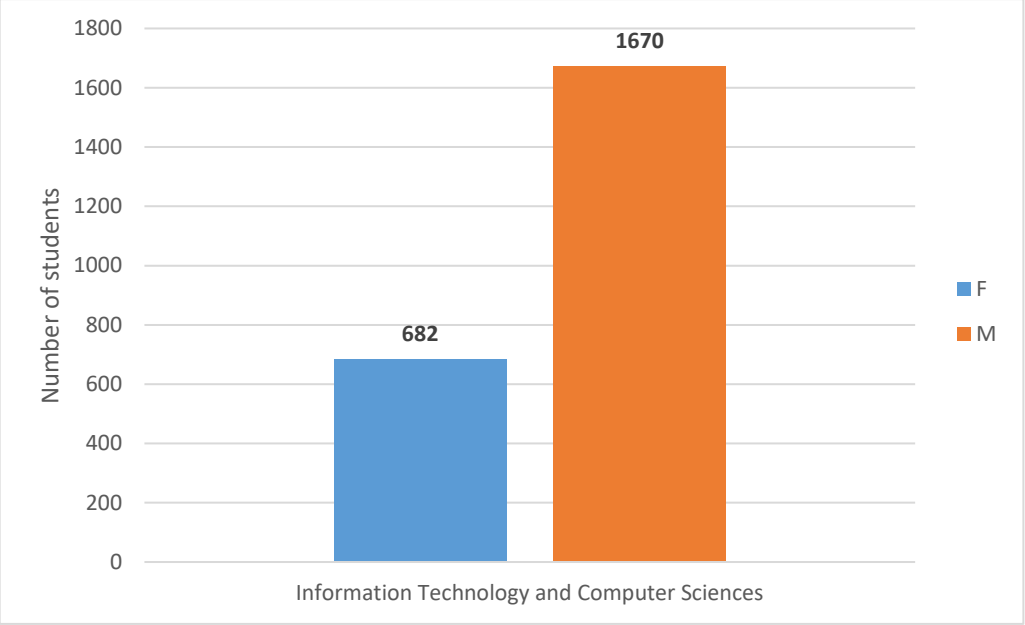
- ✓ Two HEIs (UCT and UWC) present a degree programme in Bachelor's in Commerce Information Systems. This is the only training programme that is the same in 2 of the 4 HEIs.
- ✓ There are ICT related degrees in the Bachelor's in Commerce field in Information systems and Computer Science, Information Systems and Finance that are all presented by UCT.
- ✓ ICT related fields in the Bachelor's in Science field include Computer Science (UWC), Bio-Infomatics and Computational Biology (US), Bachelor's in Science with ICT specialisation (UCT).
- ✓ CPUT also presents the Cisco Certified Network Associate (CCNA) which is similar to what is presented by FBC and CoCT. This is a vendor certified qualification.
- ✓ SUN has a large focus on data management and offer degrees in Bachelor's in Engineering; Data Engineering and ad a Bachelor's in Data Science degree. There is an entire school at the university that is focused on Data Science and Computational Thinking with various short programmes that are presented by the school.

It seems as if the HEIs have more training programmes linked to the ICT field which is at a higher level than the training programmes that are presented by the TVET Colleges. The shortage in the system is still vendor certificated training which more in line with what industry needs are.

Below is a table and graph of students who attended Higher Education & Training Institutions within the Western Cape that chose Information systems as a subject in the 2019 academic year.

A total of 2352 students exited the universities in the Western Cape with Information Technology and Computer Science as a subject (Table 18).

Table 18: Number of students who exited HEIs with ICT and Computer science subjects in 2019



Source: HEIMIS

The table above demonstrates that there is clearly a supply of digital skills entering the market. However, when the data is compared with that of depicted under the demand side of this report, it is clear that training needs to be accelerated to meet demand.

2 Consultation with PSET in the Western Cape

To get a direct sense of how PSET organisations were preparing for the demand of digital skills, consultations were held with PSET organisations in the Western Cape. These included the provincial DHET office, the 6 TVET and 1 CET College in the province, CHEC (who represents all the universities in the province), the QCTO and the SETA's. The engagements were either through emails; virtual calls, the SETA TVET Forum and virtual meetings during the period 01 July to 30 September 2020.

2.1 Education and Training Institutions' response to digitization

During the COVID-19 pandemic the TVET Colleges did everything in their power to adapt to the change in way for teaching and learning. Some colleges were more

successful than others due to various aspects such as lecturer buy-in, technological know-how and supporting infrastructure.

After the initial few months of chaos in the TVET College space, the colleges started to open some of the classroom space as per the regulations. The impact is that face-to-face training time has been cut in half, as various implementation models are being followed by the colleges. The contact time for training has been influenced severely and the students had to be more self-disciplined during this uncertain time.

The TVET Colleges had to submit a Programme Quality Mix (PQM) to DHET at the end of August 2020, but feedback on the plans for the 2021 academic year, will only be communicated in October 2020, which could have an influence on the planned programmes this academic period.

The impact of social distancing on the number of students in a classroom, which will have an impact on the number of lecturers per college, as lecturer capacity is linked to the number of students and not to the number of subjects the lecturers present. A hybrid form of training will have to be planned for the 2021 academic year where some subjects and modules are presented via online classes, and where some subjects and modules are covered in the workshop or during face-to-face interactions. This will be more demanding on the lecturers and the students, and the results can't be predicted as this is uncertain times for TVET Colleges.

The Colleges are at different stages of implementation of a digital strategy within the colleges. Some colleges do have a digital strategy, while others are still trying to figure out where to go with a digital strategy. There is also different Learner Management Systems (LMS) used by various colleges. FBC makes use of the Blackboard system, while the other 5 Western Cape TVET colleges making use of the Moodle platform. There is a lack of coordination between the e-learning managers of the TVET Colleges, which has resulted in different approaches to digitisation within TVET colleges. The lack of leadership from DHET in this regard, has also contributed to the colleges not knowing what kind of digital transformation is expected from them. DHET has rolled out an online system called the National Open Learning System (NOLS) in 2016, but this system has been dormant and not used by the TVET colleges. It is unclear if the NOLS system will contribute to the colleges digitisation of materials

and training programmes, as clear guidance on the system is currently still outstanding.

The HEIs has a need for closer collaborations with Industry to present training programmes that are more in line with what industry needs. The digital transformation for HEIs is more in the form of updated, relevant training programmes that they can present to their students, and not necessarily the focus on digital strategies and so forth. The HEIs has transform their training methodology and material to accommodate a blended learning approach, but the need now is to transform the training at the universities to what is needed in industry over a much shorter period than the normal 3-year diploma or degree period.

2.2 Sector Education Training Authorities (SETA's) response to Digital Transformation

The main purpose of a SETA is to improve and develop skills within its sector, to identify skills development needs, and to ensure that national standards are maintained. Once a SETA has been accredited by the South African Quality Assurance (SAQA) body as an Education Training Quality Assurer, it also evaluates and accredits training providers within its Sector[80].

The role of SETAs on the supply side of skills[81]:

1. Address sector skills needs and priorities;
2. Address scarce and critical skills (PIVOTAL) through implementation of learning programmes (i.e. Artisans and Learnerships);
3. Facilitate easy access and different entry points (Articulation and Recognition of Prior Learning [RPL]); and
4. To collaborate with the relevant Quality Council, especially the Quality Council for Trade and Occupations (QCTO) to ensure quality and provision of learning programmes.

From the above, SETA's develop a SSP to describe the trends in each sector, the skills that are in demand and to identify priorities for skills development.

[80] http://www.seta-training.co.za/seta-training.html

[81] DHET (2019): National Skills Development Plan 2030

It needs to be noted, for the purposes of this report, the SSP's of SETA's relevant to the priority sectors of DEDAT was analysed. The list of digital disruption on the sector and the skills needs because of it was unpacked in Part B of this report.

To delve a little deeper into the status of SETA's in response to digital disruption, and their response as a Training and Education Authority, meetings were held with a total of 11 out of the 21 SETAs during the month August 2020, to discuss the digitalisation that is taking place within the SETA environment.

The outcomes of the discussions with Bank SETA; Catering, Art, Tourism, Hospitality and Sport SETA (CATHSSETA); Construction and Education Authority (CETA) SETA; Chemical Industry Education and Training (CHIETA) SETA; Energy & Water SETA (EWSETA); Financial Accounting Services SETA (FASSET); Fibre Processing & Manufacturing (FP&M) SETA; Insurance SETA (INSETA); Manufacturing, Engineering & Related Services SETA (MERSETA); MICT SETA; Services SETA; were as follows:

- Most of the 11 SETAs indicated that due to COVID-19, they are under pressure to digitise the training material for their training programmes. There are some SETA's that have not started to look at the digitisation of any training material to date as the SETA is currently experiencing administrative challenges and this is not a priority for these SETA's.

- The challenge that was mentioned by most of the 11 SETAs is that the digitisation of the training material is relatively easy, but that the training programmes that currently registered in its current format cannot be totally digitised as it entails a 70% work-based training component which cannot be digitised. FP&M Seta indicated that all the workplace training component entails work that needs to be done with large machinery, and it's not possible to digitise this aspect.

- There are some SETA's such as MERSETA that are investigating the option of simulation and VR technologies to replace the workplace component of the various qualifications, but this is all still in exploration phases, and no clear indication of when this will be implement has been indicated. This is very much in line with what the ILO suggested the route that TVET Colleges must take to stay relevant within the digital space.

- One of the innovative ideas from Services SETA is that the SETA is investigating a digital platform that will be utilised by all the training providers to load and assess learners digitally. This will accommodate online training material and assessments that can be loaded onto the platform. This initiative is also still a draft concept, and the SETA was unclear on when this kind of platform will be ready for utilisation.

- During the conversations with the SETA's they indicated that companies are applying for Mandatory Grants to upskill, reskill or multi-skill their staff members to adapt to the changing world of work. The levy paying companies have the opportunity to apply for funding, to adapt to the digitisation in the industry, and ensure that the companies stay financially viable. The upskilling, multiskilling and reskilling of previously employed workers who got retrenched due to COVID-19 is an area that is not receiving any attention by the SETA's and is a gap in the skills development arena that needs urgent attention.

Furthermore, the Sector Skills Plans (SSP) for 15 SETA's namely: Agriculture SETA (Agri-SETA); BankSETA; CATHSSETA; CETA: CHIETA; Education, Training and Development (ETDP) SETA; FASSET; FP&M SETA; INSETA; Local Government SETA (LGSETA); MERSETA; MICT SETA; Public Sector SETA (PSETA); SASSETA; and Services SETA were evaluated for greater understanding of the drivers for change in the SETA space, and the primary change driver for skills demand and supply for all the SETAs were identified as digitisation in the different sectors, 4IR and technology. This indicates that the sectors that are linked to each SETA has acknowledged that there is a need for skills related to digital and technological innovation to stay relevant and financially viable.

Of the15 SETA SSPs that have been analysed, the PIVOTAL lists of 5 of the analysed SETAs include Software Developer and Developer Programmer as priority occupations for the SETAs. Another ICT related occupation that is also recurring on the analysed PIVOTAL lists is ICT Security Specialist, ICT System Analyst, Computer Network and System Engineer and Database Designer and Administrator.

Western Cape Government
Economic Development and Tourism

PART D

CONCLUSION AND RECOMMENDATIONS

1 Conclusion

It is generally accepted that there is world-wide shortage of people with the ICT skills necessary to boost the economies of the 21st century, Digital skills vary from low level, computer literacy skills needed by individual members of society to access services to high level technology skills needed by specialist ICT professionals. A further important group of skills are those required by managers and leaders within non-ICT sectors of the economy that allow them to use ICT effectively and innovatively[82].

The situation regarding the ICT skills gap is made more complicated as technology evolves at an accelerating pace but this rapid rate of innovation is necessary and desirable if the country is to remain competitive. Hence, to stay abreast of new technology, knowledge workers need ongoing training ('re-skilling' and up-grading of skills). Advanced qualifications and infrastructure are also required to stimulate research and innovation.

The combined impact of digital technology trends, such as the Internet of Things (IoT), big data, robotics, and artificial intelligence (AI), is changing the ways in which people, economies and societies operate. The ability of countries, organisations and individuals to participate in the growing social and economic revolution, to benefit from and to be enriched by it, increasingly depends on the acquisition and deployment of digital skills[83].

Globally and locally, the mining, manufacturing and services sectors are in the process of being transformed by digital automation, artificial intelligence (AI) and a range of other digital technologies. Furthermore, government entities, private sector firms and development institutions increasingly rely on digital technologies to drive economic growth, promote social development and provide cultural enrichment. Legacy skills, and even existing ICT skills, are becoming obsolete, while new digital skills are in short supply. This means that countries seeking to advance the competitiveness of their key economic sectors and public services need to adopt a continual skills

[82] Challenges in Ascertaining ICT Skills Requirements in South Africa, December 2010
[83] National Digital and Future Skills Strategy, August 2020

upgrade approach, where both ordinary citizens and research specialists acquire and advance their digital skills as part of a broad spectrum of 21st century skills[84].

The data presented in this report clearly demonstrates that there is a continuous reciprocal relationship which exists between the following four factors: new and changing technologies; the profile of employment opportunities (jobs) within the ICT sector and in other sectors; the acquisition of necessary skills; and the uptake of technology in the personal lives of the population. Unfortunately, this does not all happen in a neat, synchronized way. The dynamic nature of ICT creates a digital skills gap in the market, and what makes the skills shortage difficult to address[85].

The skills shortage is partially a result of ever-increasing demand for knowledge workers but is exacerbated by decreasing numbers of students enrolling for Computer Science and Information Systems courses at universities and even secondary school. The population of South Africa, with its mix of highly industrialized and technology rich areas and others with minimal access to services and technology; and affluent and impoverished communities, is impacted by the ICT skills shortage in various ways and some members of the South African society benefit in only a limited way from the opportunities that a healthy ICT sector offers. The expectation gap, that is, the mismatch or perceived lag between what is taught and what skills are needed, is in part as a result of this quite complex interaction[86].

The problems in education are receiving ongoing attention. These initiatives have in general had limited success and references are made disturbingly often to "the crisis in Education." In response, the government has launched various initiatives intended to address the problem. However, 'knowing' what the extent and the dimensions of the problem are and understanding what processes are required to address the problem, and whether these have significant impact, presents particular challenges.

Despite the supply of digital skills by our Educational Sector in the Western Cape, the delivery modalities of programmes are still predominantly traditionally lecturer-

[84] National Digital and Future Skills Strategy, August 2020
[85] Challenges in Ascertaining ICT Skills Requirements in South Africa, December 2010_
[86] Challenges in Ascertaining ICT Skills Requirements in South Africa, December 2010

centred, and there is limited use of technology for blended learning approaches. The few Colleges that make use of distance provision still use the traditional correspondence paper-based model, which does very little to support student success and has also been associated with poor success rates in the South African University Sector. Availability of ICT infrastructure varies from college to college and is a major constraint in the utilisation of ICTs to improve teaching and learning.

There are multiple stakeholders in ICT training and education, including various competing groups such as private education and training providers versus state supported colleges and universities. The future of supply of skills will be hampered by the following factors[87]:

- Higher education institutions are facing an array of challenges, from admissions policy, fee payments, student housing, the provision of bridging programmes and changes to the curricula. Even with a good understanding of the future requirements of digital skills in the marketplace, it is unlikely that HEIs will be agile enough to respond sufficiently to rapid market changes or be able to scale their outputs to meet the future demands enough.
- The growth of online platforms (i.e. Massive Open Online Courses, or "MOOC") for learning is expected to continue. Several online learning platforms have partnered with HEIs (locally and globally). Recognition by industry of online learning and self-learning can help to improve the supply of skills.
- Private sector skills development organisations are seen to be an important component of future supply. Fragmentation and disruption of the skills supply pipeline will occur as private universities and ICT focussed training institutes emerge.
- In-house skills development for industry will be driven by digital transformation requirements. The importance of digital leadership in matching skills development programmes with digital transformation will be critical.
- Affordability and accessibility of digital skills development programmes will remain problematic for a large portion of school leavers.

[87] Naidoo, R (2019): Western Cape Digital Skills Shared Agenda for Action

- ❖ The role of sector bodies, industry associations and business forums will be critical in driving the agenda for digital transformation, digital leadership and digital skills development.

The digital skill sets highlighted in the report can be summarised as follows:

Generic Digital Skills Required:

a) Office-based team with a remote virtual based team – 4IR skills such as digitization – even working remotely for some staff post Covid-19 – digital roles in the various technical areas of business.
b) Technology has become a key driver for learning delivery.
c) Web interface, web designing, data analytics and OD consulting. Also, additional fibre skills.
d) Covid-19 has fast-tracked strategies to enhance online customer service.
e) Administrative roles have changed through the introduction of more automated processes, viz. paperless environment.

List of new and emerging occupations across Sectors

a) Data Analyst
b) Data Scientist
c) Project Managers
d) Actuary
e) IT Software Developers
f) User experienced engineers
g) Artificial Intelligence (AI) and Machine Learning (ML) specialist
h) Robotics Engineer

List of new and emerging top-up skills needed across Sectors

a) Technology
b) Big data & analytics
c) Digital Literacies
d) System Architects
e) Working out premiums through actuarial systems
f) Health & Safety
g) Leadership
h) Wellness
i) Change Management

The above demonstrates that digital skills varies in degree of competencies, from basic to the advanced. Furthermore, skills required are not only technical in nature, individuals require a set of '*soft*' skills to navigate through though the challenges and opportunities that digital transformation offer us. Thus, in response to an everchanging technological environment, it is essential for individuals to be skilled, re-skilled and upskilled on a continuous basis. Jobs losses because of technology adoption across sectors is indeed a reality but can be minimised with the re-imagining of roles for individuals.

Descriptors for '*jobs of the future*' are likely to be far more generic involving a foundational portfolio of portable skills and knowledge applicable across multiple sectors and required by many industries and government services, as can be seen in the figure below. As a result, individuals need to be equipped with the knowledge and skills in one or a few technology fields can offer the foundation for broader job descriptions[88] (Table 19).

[88] National Digital and Future Skills Strategy, August 2020

Table 19: Job Descriptors for Digital Transformation

Associated Technology	New Job Descriptors
All technologies	Analytical engineers; digital ethics officers; futurist; digital risk managers; governance practitioners...
Algorithms	Business intelligence engineer; database architect; data automation programmer; data scientist; machine learning scientist; research scientists in multiple fields including quantum computing, neuromorphic computing and other applications fields; relevant digital executive positions...
Artificial intelligence (AI)	Applications developer; AI developer; intelligence analyst; user interface/user experience (UI/UX) designer; robotic process automation and AI transformation specialist; AI and game theory research scientist; machine learning engineer...
Big Data	Big data specialist/developer/engineer; data scientist; big data team manager...
Cybersecurity	Security tool specialist; security analyst; project manager; incident response specialist; data scientist; scripting specialist (Python, Perl, etc.); soft skills; digital forensics expert; cybersecurity regulatory specialist...
Digital Communications	Digital content manager; digital graphic designer; digital arts professional; digital archivist; digital marketing specialist; digital media designer; digital media editor...
Digital Modelling	Digital process automation architect; enterprise security engineer; data scientist; digital banking professionals; digital manufacturing engineers...
IoT	Data scientist; IP network engineer; digital systems developer (specializing in hardware interfacing); mobile application developer; UI/UX designer; information security specialist; cybersecurity specialist...
Machine Learning	Machine learning engineer; computer vision and machine learning scientist; medical image analyst; manufacturing engineer/ programmer
Mechatronics	Mechatronics engineer/architect; innovation and design engineer (robotics and mechatronics); research scientist automated driving; manufacturing engineer
Networks and cloud computing	Cloud computing solutions engineer; solutions architect healthcare and life sciences; cloud AI research specialist; high performance computing cloud specialist; network engineer; consulting engineer
SQL, NoSQL	NoSQL data architect; business intelligence specialist; data scientist; AI scientist
Robotics	Robotics engineer; applied robotics scientist; research scientist AI and machine learning; robotic process automation (RPA) developer...
Sensors and Actuators	OEM systems engineer; product and application development scientist; AI research scientist;
Simulation	Simulation environment architect; simulation scientist; simulation engineer; data scientists
VR, AR, MR	AR/VR specialist solutions architect; AR/VR developer; digital content creator (for animation, gamification)...
Wide range of technologies	3D architects and designers; crowdfunding specialist; drone pilot; gaming tutor; blockchain and cryptocurrency technologist; cryptocrimes investigator...
Technology agnostic	Management level jobs (actual jobs advertised for Johannesburg October 2018) Digital account manager/executive; digital brand marketing manager; digital media strategist; manager operations and digital enablement; manager social media and digital marketing; digital strategist; digital product manager; digital product innovations manager...
Technology agnostic	Operational level jobs (actual jobs advertised for Johannesburg October 2018) Social media content developer; coding platform integrators; digital designer; digital business analyst; digital writer; mobile digital architect; digital conceptual copywriter; digital portfolio manager; digital multimedia expert and web designer; IT audit practitioner; teachers; health professionals; digital community champions...

Source: National Digital and Future Skills Strategy, August 2020)

High levels of digital skills and 21st century life skills, including scientific, digital, financial and cultural fluency; critical thinking and problem-solving skills; as well as agility and leadership are required. These skills will enable individuals to function within a twenty-first century world increasingly pervaded by and dependent upon digital technologies. Digital skills are no longer just for ICT practitioners, they are for everyone.

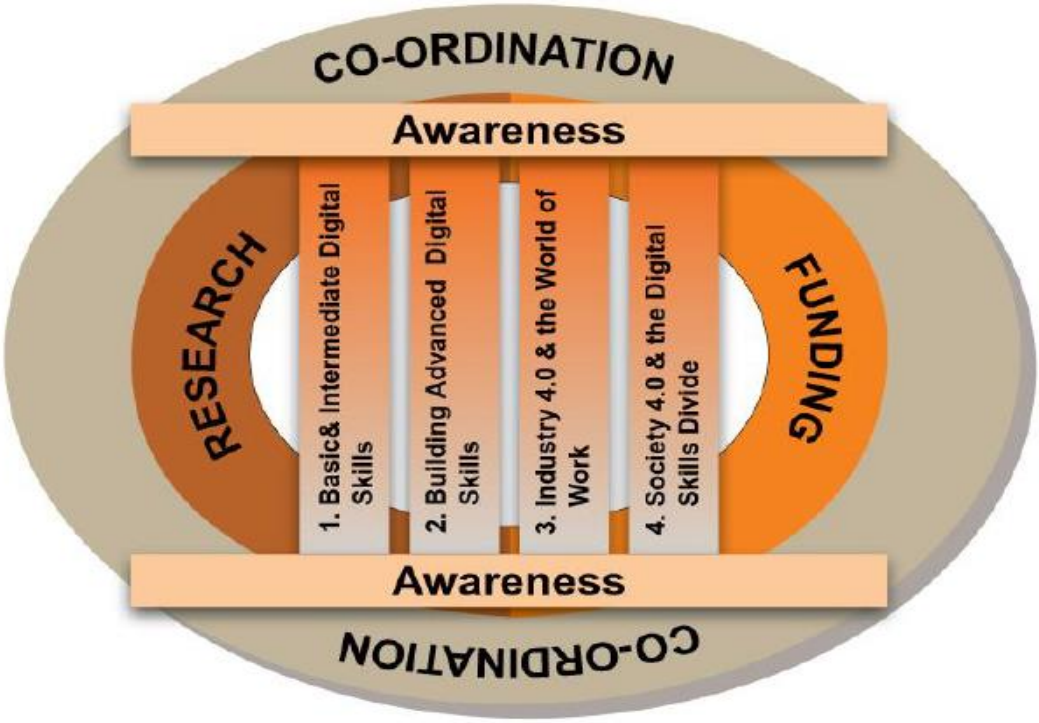
2 Recommendations

The whole of society must become digitally adoptive and digitally adaptive to ensure digital inclusivity for future generations. The challenges implied by these ongoing developments, therefore, requires that South Africa adopt a clear and comprehensive Digital and Future Skills strategy to foster the country's ability to engage with, compete within, and benefit from the emergent digital revolution, also referred to as the fourth industrial revolution[89].

To take advantage of what 4IR must offer business, governments must collaborate to be able to develop, attract and retain the skills and capabilities. Ministries of Education need to re-think how skills can be obtained. Governments and communities need to take a fresh look at how they develop emerging technology skills and knowledge.[90] This calls for a Digital Transformation Strategy that will essentially affect a Digital Skills Evolution in South Africa[91]. Eight (8) elements of the strategic approach towards a digital skills evolution can be depicted as follows (figure 25):

[89]National Digital and Future Skills Strategy, August 2020
[90] Fryer, D (2020): Brief: Digital transformation impact on businesses within South Africa
[91] National Digital and Future Skills Strategy, August 2020

Figure 25: Eight Strategy Elements to Foster Digital Skills Evolution



Source: National Digital and Future Skills Strategy, August 2020

[92]The first four (4) elements of the strategy addresses:

Strategy element 1: Digital foundations: Basic and intermediate digital skills, which identifies three key interdependent areas of initiative to develop digital skills, namely:

i. Designing, writing content for and continuously revising curricula to build a wide range of digital skills, constantly adapting to changing knowledge needs;

ii. Building capacity to ensure all educators are empowered with digital skills and that these skills remain current;

iii. Providing access to the necessary infrastructure that enables digital skills and making sure this is operational, secure and sustainable.

Strategy element 2: Digital futures and mastery: Building advanced digital skills, where strategy elements include tertiary curriculum reform; capacity-building for lecturing staff; promoting research related to the digital skills revolution; developing and promoting usage of mobile open online courses to develop digital skills

[92] National Digital and Future Skills Strategy, August 2020

on a widespread basis; and measures to strengthen the CoLabs, tech hubs and all related institutions.

Strategy element 3: Skills for Industry 4.0 and the world of work, which recognises the need for research into the impact of the digital revolution on South Africa's labour market, notes that the current skills gaps need to be addressed, and that school-leavers need to be equipped with work-ready digital skills. Programmes are required to reskill those displaced by digital technologies, as well as to provide ongoing upskilling in the workplace, including in government itself where the transition to digital government requires such upskilling.

Strategy element 4: Creating Society 4.0 and addressing the digital skills divide recognises the challenge of the digital skills divide with many disadvantaged by race, gender, geographic location, and income, highlighting the need to equip individuals and communities with digital skills, to empower them as citizens and for effective participation in the 21st century society.

The remaining four strategy elements are cross-cutting to the above four, namely:

Strategy element 5: Building digital skills awareness, where the success of any digital skills strategy depends on a high-profile campaign of engagement to ensure digital skills development is on the national agenda, through flagship events, supported by ongoing stakeholder engagement, and a variety of measures to build public awareness of the issues, options and opportunities.

Strategy element 6: Research and monitoring on digital skills, noting that a strategy for the effective development of digital skills needs to be supported by a benefits realisation approach at national and institutional levels, as well as by adequate data and practical research in order to assist in monitoring and reporting on the effectiveness of the strategy implementation, as well as the relevance and resilience of the strategy elements.

Strategy element 7: Co-ordination across government, industry, labour and other stakeholder groups, noting that effective mechanisms and structures for co-ordination are critical to the success of the Digital and Future Skills Strategy, both

within government and across the country at national and provincial levels, involving all stakeholders and role players, with particular attention to the representative structures for the labour market and for skills development, including the labour unions and the SETAs.

Strategy element 8: Funding for digital skills, which stresses the importance of funding resources to underpin digital skilling initiatives and includes a number of options to secure this.

Transformative role of digital technologies in the economy is only possible where many levels and layers of digital skills are available in the labour market. The absence of digital skills excludes economic participation, while the presence of digital skills encourages economic participation. Digital technologies may have a low, high, or transformational impact on business and government. The disruptive effects of digital technologies may lead to short-term and long-term job destruction. New and better jobs, or employment opportunities, or entrepreneurial and self-employment opportunities, are only possible where major investments in digital skills are made over an extended period of time. To become a medium to high growth economy, South Africa needs to advance digital skills for the workforce at an unprecedented level, particularly for low-skilled workers who will otherwise bear the brunt of job vulnerability.

The investigation of these recommendations outlined in the report will assist to shape the future planning of the Skills Programme to:

- Analyze the key 8 strategies depicted and identify interventions and innovations that will enhance the skills eco-system by supporting and increasing the reach and scale of skills interventions. These interventions will target the supply of relevant skills for current and future demands of priority sectors in the Western Cape;

- Identify interventions and innovations that will enhance the skills eco-system by supporting and increasing the reach and scale of skills interventions. These interventions will target the supply of relevant skills for current and future demands of priority sectors in the Western Cape;

- Lead stakeholder co-ordination to drive collaborations between stakeholders to address immediate to long skills needs and drive systemic change to improve the skills supply pipeline;

- Coordinate the implementation of joint projects between stakeholders that address immediate skills needs and ensure that these skills offerings are responsive to industry needs; and

- Implement WCG funded interventions that support collaborations to address blockages and support innovative to equip people with the skill sets for the future to improve their employability and livelihoods.

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Programme 7 : **Skills Development and Innovation**

Sub-Programme 7.1 : **Provincial Skills and Partnership**

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