



2018 JCSE-IITPSA ICT Skills Survey

Joburg Centre for Software Engineering and IITPSA
(Institute of Information Technology Professionals
South Africa)

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EXECUTIVE SUMMARY

The Joburg Centre for Software Engineering (JCSE) is a University of Witwatersrand partnership with government and industry, founded in 2005. IITPSA (the Institute of Information Technology Professionals South Africa) is the 61-years old professional body for the sector. This is the JCSE's ninth edition of its survey of skills trends in the South African information & communications technology (ICT) sector and its first in full partnership with the IITPSA.

The state of the South African economy continues to restrict growth in the demand for ICT skills as the sector's clients limit their budgets. The global market structure is shifting under the influence of the Trump Administration in the US and the increasing presence of China outside of its own borders. Demand in developed economies (and in many developing ones) for ICT skills is generally strong. South Africa is lagging its peers in Africa (notably Kenya, Nigeria, Rwanda and Egypt) who continue to derive the benefits that technology adoption add to economic growth and social development.

Unacceptable delays in implementing policies, such as the migration from analogue television signals and the rollout of broadband networks, continue to frustrate the potential contribution of the ICT sector to the overall economy. We are encouraged by President Ramaphosa's commitment to speeding up these processes and look forward to seeing his statements converted into action.

We emphasise again our concern at the slow pace of improvement in South Africa's basic education for the majority of pupils. Exposure to and familiarity with ICTs for all learners is essential, in order to equip them to adapt the modern tools to their daily lives. Some laudable initiatives have appeared (such as the use of tablets in Gauteng schools) but they have yet to reach a sustained, critical mass for all grades of learner. Of over 1 million pupils entering the schooling system each year, only half will write matric and less than 20% will be able to enrol for tertiary studies.



**Stagnant
economy**
Policy delays
Basic education

THE ICT SECTOR

Although it is commonly recognised that ICTs are the tools that enable improved performance in most fields of human endeavour and that growth in the use of ICTs is critical to building sustainable economies and social cohesion, we continue to suffer from a lack of current, coordinated data about the so-called ICT sector in South Africa. "So-called" because it is almost impossible to define where the creation and implementation ends and the embedded use and further development of ICTs begins.

Too many state entities have disparate views on their roles in regulating, acquiring, implementing, promoting and utilising the broad range of elements that come under the ICT umbrella. These varied perspectives and conflicting mandates encourage the waste of resources and dissipation of holistic approaches. The alphabet soup of entities influencing policy and practice contains too many to mention – DTPS, DOC, DTI, DST, SITA, SETA, DBE, DHET, iNeSI...


The 2018 National List of Occupations in High Demand contains a broad range of ICT occupations. These are chief information officer (CIO), ICT project manager, data management manager, application development manager, information systems manager, IT manager, computer quality assurance specialist and ICT communications assistant. (One would wonder how the latter occupation appears in the list of much more senior roles.)

Higher- and high-demand occupations in the ICT sphere include ICT systems analyst, software developer, ICT risk specialist, programmer analyst, developer programmer, applications programmer, data quality officer, decision support analyst, computer network technician, geographic information system specialists and technicians, multimedia designer and web designer, web developer, database designer and administrator, computer network and systems engineer, network analyst and ICT security specialist.

However, as we will show in our review of the various Sector Skills Plans, it is very difficult to see how this list was derived and impossible to quantify the numbers of practitioners required and what the trends are.

This lack of useful data leads to fragmented policy initiatives based on flimsy and obsolete information, the effectiveness of which cannot be properly measured. The JCSE and IITPSA urge all the stakeholders to recognise their dependence on ICTs and to integrate their activities, horizontally and vertically, to create a sound, holistic foundational view of the attributes and dynamics of the country's ICT enterprises and practitioners.

These comments sound familiar because they are. South Africa's leaders must come together to create the critical mass required to energise the economy through implementation of ICTs and, in particular, domestic products and services that can leverage the access to global markets.



**Whose sector is
it anyway?**

ICT SKILLS ENVIRONMENT

The global ICT industry is now estimated to reach US\$5,5 trillion in annual revenues by 2020, according to IDC. (IDC, 2017) They emphasise that such technologies as Internet of Things (IoT), Robotics and Augmented Reality/Virtual Reality will drive the next wave of growth – a growth of more than 35% from the estimates for 2018. It is hardly surprising that the demand for the skills to create, implement and support these technologies remains high across the world.

The increasing reach of high speed broadband networks supports the growth of ICT related activities in regions such as Africa, which are proving to be cost-effective locations for the infrastructure required by the explosion in innovative technologies, such as Artificial Intelligence (AI), Internet of Things (IoT), big data/data analytics, cloud services and cryptocurrencies. Africa represented only 2% of the global ICT market in 2017 (PRNewswire, 2018), so has enormous potential to harness the economic and social development enablers of ICTs.

In September 2018, the Sydney Morning Herald published an article under the heading, “Three-quarters of new Aussie Tech jobs to be imported, report shows” (Hastie, 2018), pointing out that 100 000 new ICT roles would have to be filled by 2023 but that there are only 5 000 domestic graduates per year. The writer goes on to say that Australia should be targeting 200 000 new ICT roles if they are to meet their ambition to be a global digital leader.

There is no question that the global ICT industry continues to create high levels of employment for skilled practitioners. The need to translate masses of data into commercial and social value while protecting the users and subjects of that data from cybercrime and privacy abuse will grow exponentially, in tandem with the spread of the networks and data centres housing the information.

THE SOUTH AFRICAN CONTEXT

The South African economy continues to be plagued by political issues and a high level of corruption that is diverting vital resources away from building a healthy and growing GDP. The ICT sector is estimated to contribute more than R250 billion (approximately 6%) to the country’s R4 trillion GDP (MICT SETA, 2017). Good growth in the agriculture sector in Q2 of 2017 reversed the recession of the previous two quarters but this was a “flash in the pan” and South Africa has again retreated into recession in 2018.



**R276 (US\$19)
billion out of
US\$ 5,5 trillion
market**

Gartner’s John-David Lovelock forecast that South Africa’s IT spend would reach R276 billion in 2018, up 4,3% from 2017 (ITWeb, 2018). Within this increase, software is predicted to grow by 12,5%, device spending showing a minimal growth of 0,9% and a similarly flat communications services market. IT Services (the second largest sub-sector) will show an 8% increase.

Exacerbating the lack of overall market growth is the continuing restriction of the skills pipeline through poor performance in the maths and science education in schools. The 2016 South African Science, Technology & Innovation indicators report, released in September 2017, shows stagnant numbers of matric passes in these critical subjects and in the numbers of science, engineering and technology (SET) enrolments at tertiary institutions (National Advisory Council on Innovation, 2017).

We are concerned that prolonged failure to improve the science, technology, engineering and mathematics (STEM) output from the education pipeline will have a serious negative impact on South Africa’s ability to counter the growing risk of cybercrime attacks (estimated as costing R1 billion each year), as well as on our capacity to maintain a competitive and innovative ICT industry.

There is a critical need for academia and business to partner in influencing government's understanding of future skills, so that all three spheres can invest in the development of people, to ready them for the changed roles that will come from "Industry 4.0". President Ramaphosa's Youth Employment Service (YES) should recognise such relevant training within its programme.

CLOSING THE GAP

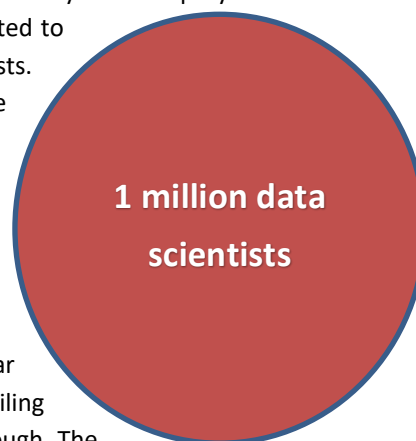
Away from the failure of the education departments, we are pleased to observe many private sector initiatives to address the skills gap. Although one could argue that this is self-interest, most of the programmes reach beyond the needs of a vendor to support its products and offer genuine skills upliftment and employment opportunities.

The JCSE has continued its partnership with BankSETA which has funded 50 students through the Digital Skills Pipeline Programme, a two-year programme to improve employability of matriculants and graduates by teaching them scarce IT skills and exposing them to realistic project experience. Their progress is measured by sitting internationally recognised certification exams, such as CompTIA A+ and relevant Microsoft or Oracle programming exams. Content for the courses is provided by Cisco and Accenture. The curriculum covers IT Essentials, programming in C# or Java, configuring networks, designing databases and writing SQL. For the second year, students are placed in self-funded internships or trainee developer posts.

Another initiative, aimed at boosting recruitment of programming graduates, is WeThinkCode (WTC). This is a free 2-year course sponsored by corporates such as BBD and requires only aptitude and enthusiasm as the entry criteria.

Three universities have partnered with Amazon Web Services (AWS) to offer a specialised cloud-computing focused curriculum. Others may join the programme later.

We were somewhat surprised by the announcement in August 2018 by the Deputy Minister of Telecommunications and Postal Services that the government has committed to train a million young people between 2019 and 2030 to become data scientists. On the face of it, this is a very welcome initiative, but examination of the numbers causes some doubts about the feasibility of the programme. As Moira de Roche (a director of IITPSA) commented, "One can't just churn out data scientists; instead they need some specialist skills which are only built by experience of about five to eight years." BCX's Explore Data Science Academy (EDSA), offering students the opportunity to learn how to solve real-world problems during a one-year engagement, using the latest data science tools and methodologies has begun this journey but at nowhere near the scale the Deputy Minister envisages. We tend to agree with the prevailing opinion that reaching even a tenth of this ambitious goal would be very tough. The EDSA is offering 300 or 400 internships over 2018/2019.



Hopefully, more realistic results will flow from the launch of Microsoft Azure data centres, intended to add 53 000 new jobs by 2022, with an additional 112 000 generated through other cloud services. The practitioners to fill those jobs must be appropriately skilled. Microsoft claims its programmes can train school leavers to the level of software engineer or data scientist.

SURVEY PROCESS

The Skills Survey continues to follow the process established in 2008. Its objective is to identify the most pressing skills needs from the corporate perspective, balanced with the view of current skills capacity of the practitioners and their intentions for future skills development. The questionnaire, devised by the JCSE, is in a consistent format to track trends and is published as an on-line survey. In 2018, as for the previous four surveys, we were assisted in this regard by Eduflex (a Cape Town company), who gave us the use of their Virtual Assessor™ survey engine and hosted the on-line access. Our thanks go to their team for great support.

We acknowledge the new partnership with the IITPSA (Institute of Information Technology Professionals South Africa), and the assistance of the Information Technology Association in bringing the survey to the attention of their members.

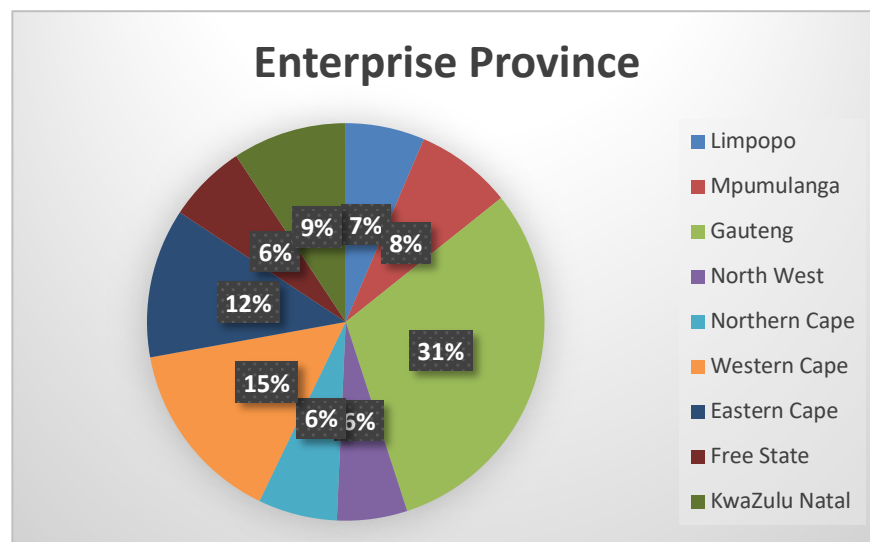
The data gathered from the questionnaire is put into context by an environment scan and literature review.

Any use of this Report (in whole or in part) must acknowledge “2018 JCSE-IITPSA ICT Skills Survey” as the source. Please direct any queries and requests to research@jcse.org.za or ceo@iitpsa.org.za.

CORPORATE RESPONSES

In this section of the report, we analyse and comment on the responses received from employers, usually from the executives and managers responsible for ICT creation, implementation and support functions. Corporate response levels in 2018 are similar to those experienced in the previous surveys.

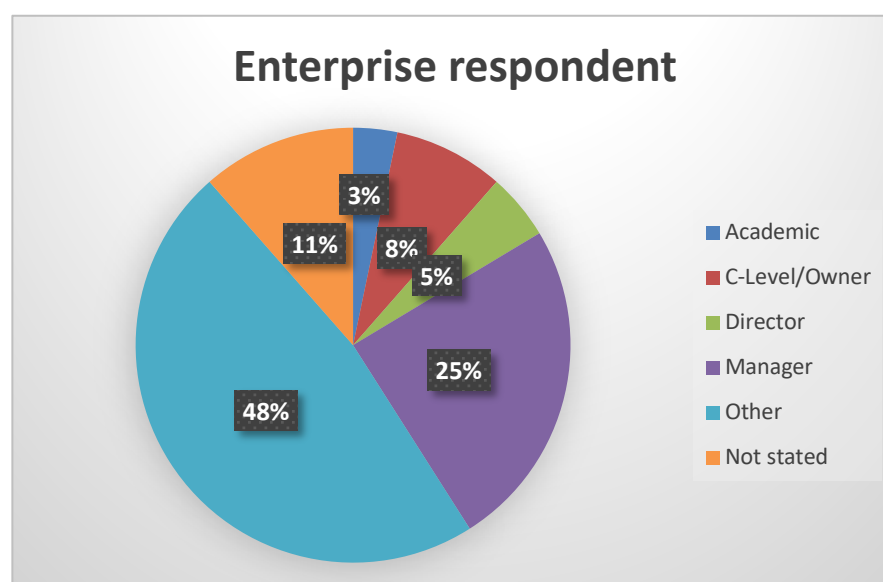
PROVINCES



All nine Provinces were represented, as they have been in all except our first survey in 2008, and 31% (2017: 35%; 2016: 38%; 2014: 45%, 2012: 42%, 2011 – 34%, 2010: 40%) of the respondents were located in Gauteng, 15% (2017: 16%; 2016: 12%; 2014: 23%, 2012: 24%, 2011: 27% , 2010: 44%) in Western Cape and 9% (2017: 9%; 2016: 14%; 2014: 10%) in KwaZulu Natal. We are encouraged

by the increased interest in the Eastern Cape. This pattern is a reasonable reflection of the geographical distribution of ICT enterprises in South Africa.

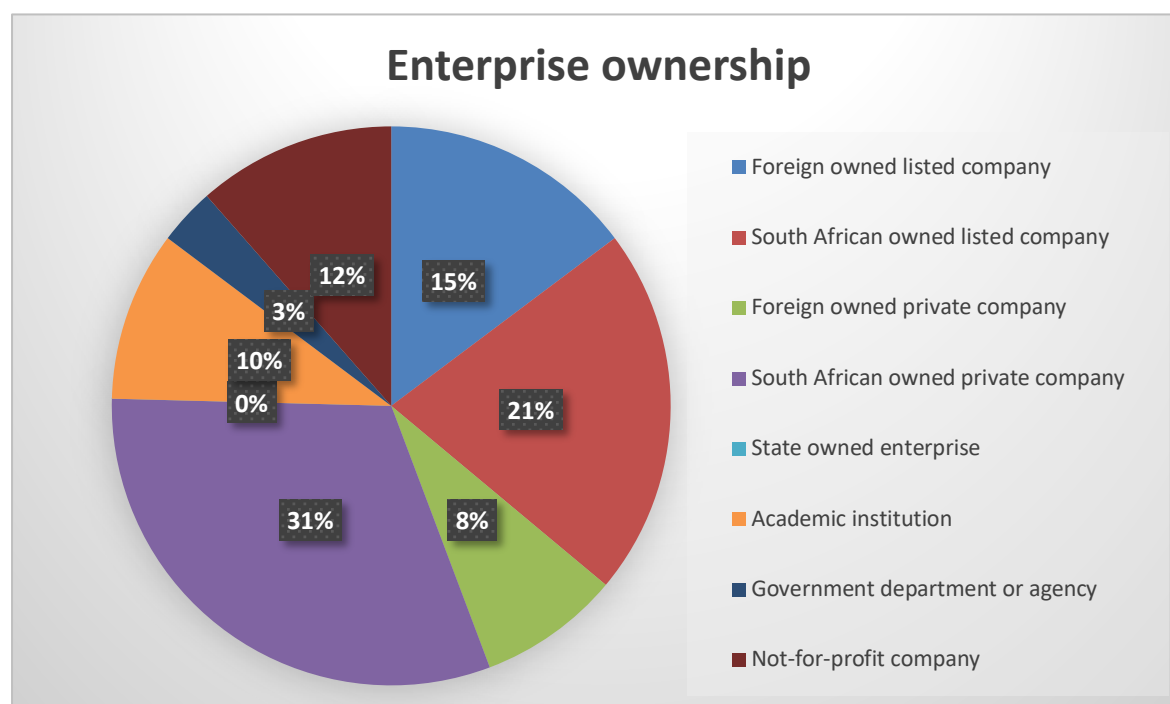
RESPONDENT LEVEL



Slightly lower participation at senior level this year, with 13% being C-level executives or Directors (2017: 19%; 2016: 7%; 2014 - 26%; 2012 – 27%; 2011 – 48%; 2010 – 34%; 2009 – 45%) but the same input from Managers at 25% (2017:25%; 2016: 23%; 2014 - 38%; 2012 - 40%; 2011 - 42%; 2010 – 30%; 2009 – 25%). 48% of respondents' job titles were not clearly executive or management level.

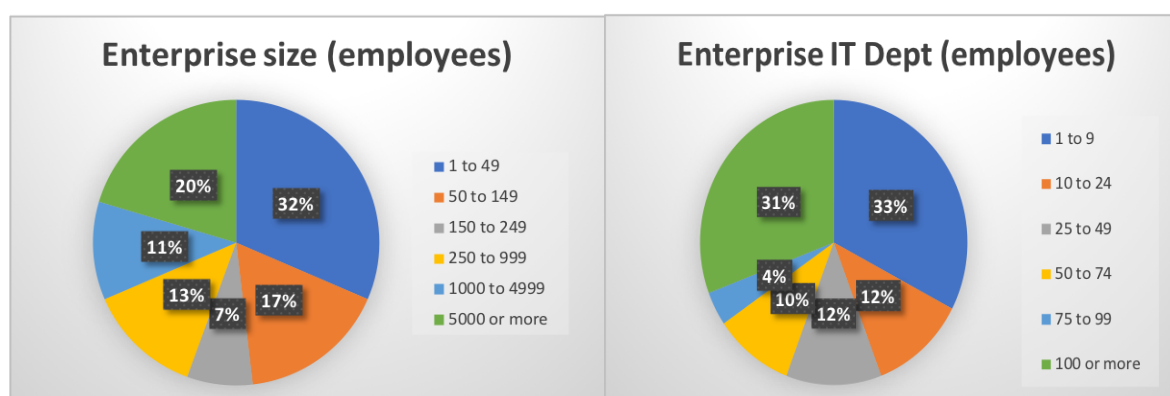
TYPE OF ENTERPRISE

The trend to a lower proportion of South African privately-owned (non-listed) companies in this survey at 31% continued from last year (2017 39%; 2016:40%; 2014 - 44%; 2012 - 56%; 2011 - 63%) but South African listed



companies were above previous levels at 21% (2017 17%; 2016:9%; 2014 – 18%; 2012 -18%; 2011 - 19%; 2010 - 13%). Altogether, three-quarters of respondents are from private sector enterprises and more than one-fifth of those enterprises are foreign-owned. No state owned enterprises responded this year, which is disappointing.

SIZE OF ENTERPRISE



32% of the enterprises have less than 50 employees (2017 29%; 2016: 46%; 2014 – 41%; 2012 – 45%; 2011 - 44%; 2010 – 62%; 2009 – 50%; 2008 – 40%) and 37% have between 50 and 250 staff members (2017 13%; 2016: 22%; 2014 – 32%; 2012 – 28%; 2011 - 16%; 2010 – 25%; 2008/9 - 20%).

33% of respondents' enterprises employ less than 10 people internally to supply ICT functions (2017 26%; 2016: 29%; 2014 – 27%; 2012 – 31%; 2011 - 39%; 2010 – 45%; 2009 – 40%). 31% of this year's respondents have greater than 100 practitioners in their IT department (very slightly lower than 2017).

Regular readers of these Survey reports will know that we endeavour to make comparison with the sector's formal data source, so we look to the MICT SETA's Sector Skills Plan (SSP) for the next 5 years, published in August 2017 (MICT SETA, 2017). Tables and figures are copied from that Plan. We are concerned about some

Table 3: The MICT Sector Size of Employers per Sub-Sector

	Large		Medium		Small	
Sub-sector	2016	2017	2016	2017	2016	2017
Advertising	14	18	42	53	2618	2831
Electronics	70	76	97	113	2556	2946
Film and Electronic Media	40	47	54	56	2365	2615
Information Technology	154	170	302	351	9795	12178
Telecommunications	45	54	105	100	3089	2493
Grand total	323	365	600	673	20423	23063

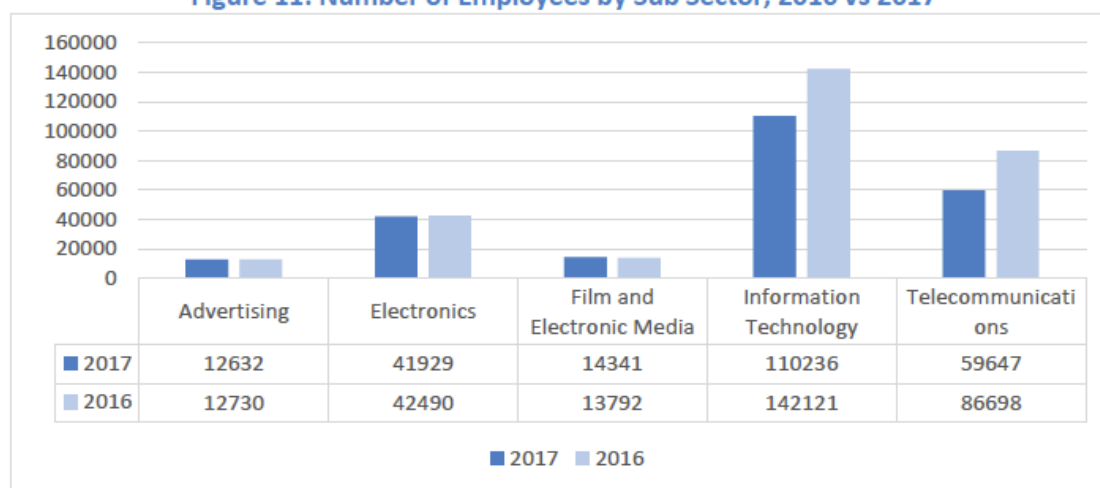
Source: The MICT SETA OGS, 2017

discrepancies appearing in the "final" version of the SSP. For example, the Grand total line for the table above reads 329, 372, 600, 716, 20423 and 25301, in spite of the detail lines being unchanged. We have opted to use the earlier version of the table from last year. The text of the SSP states that the MICT sector is currently made up of at most 26,955 companies spread across the five sub-sectors (allocated to the MICT SETA through the SARS registration process).

We should note that the MICT SETA size breaks are: Small, below 50 employees; Medium, 50-149 employees; Large 150 or more employees. Of these enterprises, 24,4% (6 602 employers) pay levies to the SETA. 49% of levy value comes from the IT sub-sector, 13% from Electronics and 14% from Telecommunications.

The MICT SETA acknowledges that there are challenges in extracting employment data beyond that reported in the Workplace Skills Plans (WSPs) as there are no disaggregated data from StatsSA. The 2017 SSP (op.cit.) reports an estimated total of 241 535 employees in the levy-paying portion of the MICT sector, a major drop from 297 831 they report for 2016 and 274 095 for 2015 but significantly up from 153 880 in 2014, 162 579 in 2013 and 193 032 in 2012 (181 157 in 2011). The variations in these numbers are considerable and we would like to see a detailed analysis at the employer level.

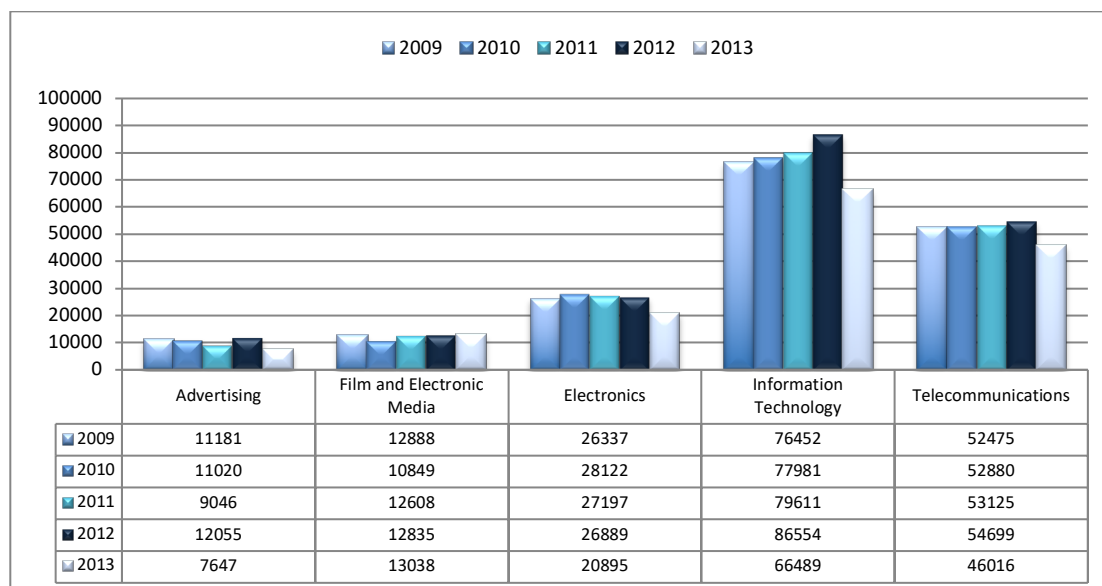
Figure 11: Number of Employees by Sub Sector, 2016 vs 2017



Source: MICT SETA OGS, 2017

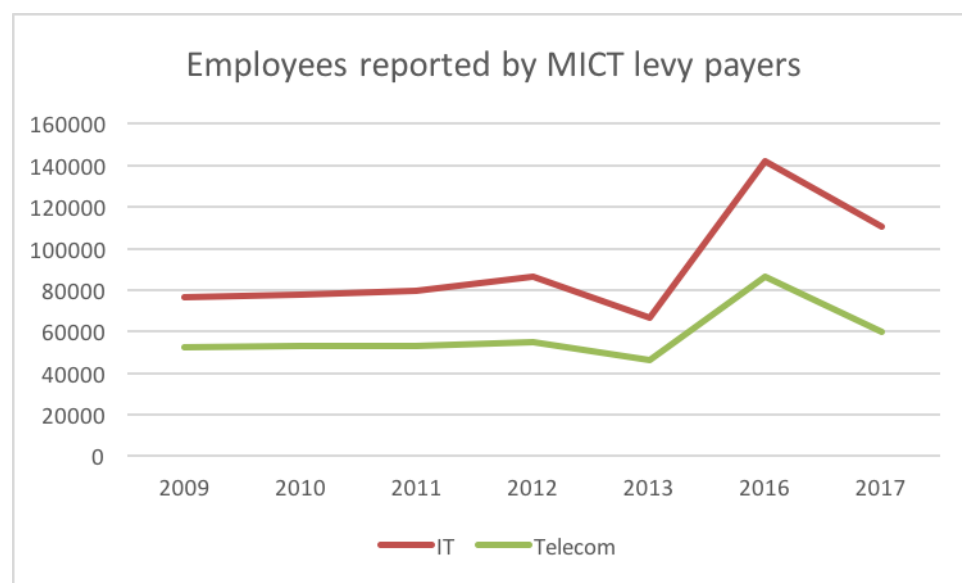
We note that the current SSP does not include the historical data on employee numbers, so we have retained the chart from the 2014 SSP (see below) for comparison purposes.

Number of Employees by Sub-sector, 2009 to 2013



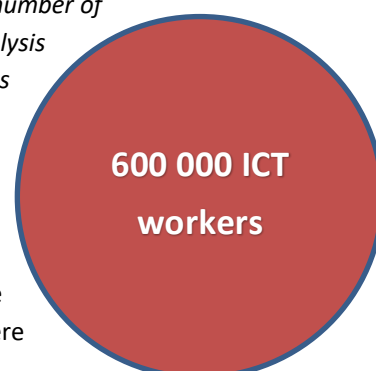
Source: The MICT SETA OGS

We note that it can be difficult to measure the effect of interventions concerning employment in the ICT sub-sectors, given the variations in employment numbers appearing in these reports. For example, we have charted the employee numbers reported in the MICT SETA SSPs in 2014 and 2017 for the IT and Telecommunications sub-sectors in the following graph:



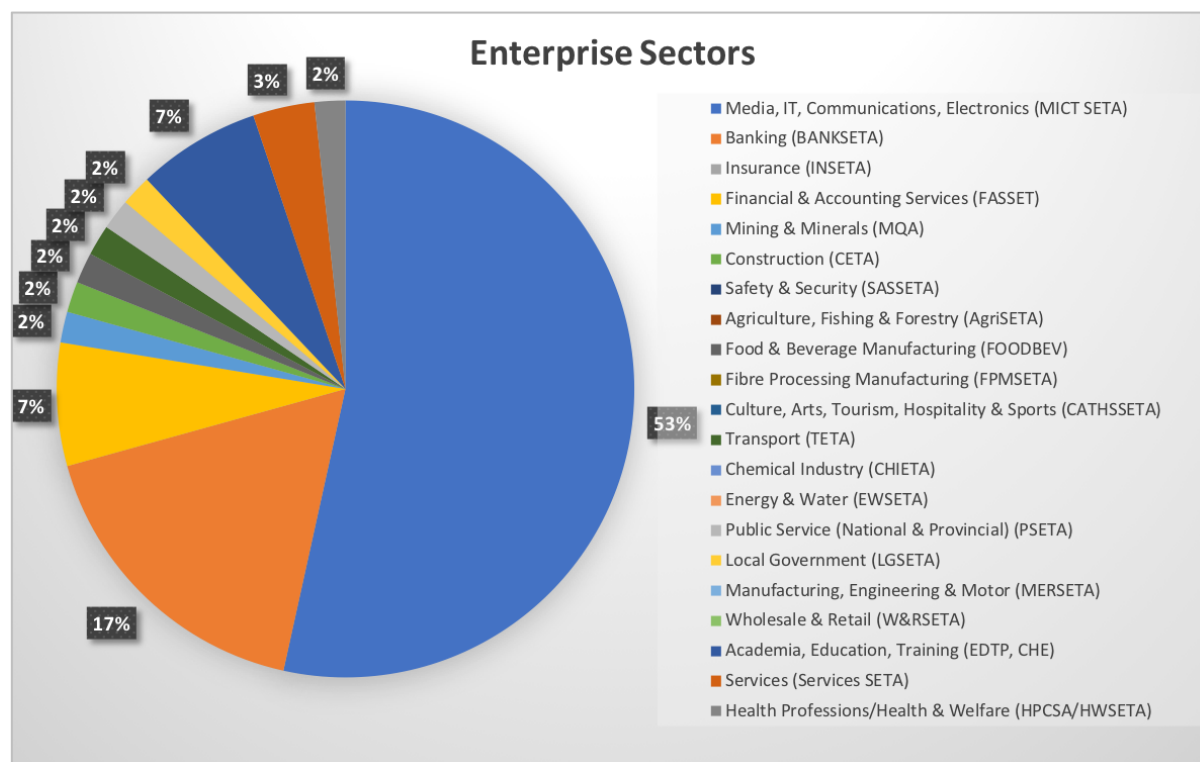
The SETA's frustration is evident in the comment in the current SSP: *"Total number of employees recorded from employer levy records in 2017 is 241,535. The analysis of WSPs submitted in 2016, there were 297,831 people employed in companies submitting WSPs, up from 274,095 based on 2015 submissions. The consistency of employers in submitting annually is important and the lack thereof always leads to anomalies."* (op.cit.)

As we will show later, it is difficult to estimate the number of ICT "people" in total, so we will continue to adopt the conventional wisdom that there are as many "ICT" practitioners employed in non-MICT sector companies as there



are indicated above. This would arrive at an estimated South African ICT practitioner population of around 600 000. However, this will remain in the “guesstimate” category until we can source more reliable and complete statistics. In May 2018, IDC’s Mark Walker indicated their data shows total IT employment in South Africa as 522 000 people, expected to increase by as many as 119 000 over the next 5 years.

SECTORS



This survey elicited responses from employers in 15 of the sectors represented by SETAs. This is lower than the 18 reporting in 2017 but higher than the 2016 coverage.

Of the responding enterprises, 53% were operating in the MICT (including electronics) sector (2017 40%; 2016: 52%; 2014 - 56%; 2012 – 54%; 2011 – 53%; 2010 - 67%; 2009 – 57%); 7% (2017 10%; 2016: 22%; 2014 - 6%) in the Education/Training cluster; 17% (2017 7%; 2016: none; 2014 - 5%) in Banking and 7% (2017 9%; 2016: 5%; 2014 - 3%) in Financial and Accounting Services.

Lower than last year, 70% (2017 – 85%; 2014 - 82%) of the responding enterprises have been in business for more than 5 years and we continue to observe a growing proportion at 12% (2017 9%; 2016: 5%; 2014 - 2%) existing for less than 2 years.

SECTOR SKILLS PLAN CORRELATION

MICT SETA

The JCSE-IITPSA ICT Skills Survey samples the views of employers and practitioners in the ICT field with the intention of informing decisions about skills development, particularly but not exclusively in respect of tasks related to software creation, implementation and support. This work is seen as complementary to the statutory data presented in the Sector Skills Plan (SSP) (MICT SETA, 2017) produced annually by the Media, Information & Communications Technologies Sector Education & Training Authority (MICT SETA).

In examining the relationship between the two, it is important to understand the difference between them. The corporate data gathered by the JCSE-IITPSA is supplied voluntarily by executives and managers in response to invitations to participate published in the media, direct approaches and through various institutions and

associations. The “ICT operations” that they manage will exist within enterprises from all economic sectors, as well as from those that are seen as ICT companies. However, it is only the latter group that falls within the ambit of the MICT SETA – its levy payers. The JCSE Survey focuses on ICT practitioners in all sectors, while the MICT SETA data includes only employees in MICT levy-paying companies.

The different rationales for the two reports (this Survey and the SSP) lead to different views of what should be the same phenomenon. The levy payers’ reports of hiring reflect the reality of filling vacancies, while the respondents to the Survey tend to indicate what they want, rather than what they get. The Survey traditionally reports a much higher demand than the SSP – demand that would be satisfied if supply at the right price was available and not constrained by external factors. This demand scenario is also reflected in the regular Career Junction Index (CJI) reports, available online from <https://www.careerjunction.co.za/downloadindustrytrends>. The August 2018 edition of the CJI indicates software development and programming remain the most sought-after skill sets on Career Junction (Career Junction, 2018). According to CJI, in spite of an overall decline in labour demand, Information Technology remains one of the 5 sectors that show positive employment prospects, with a demand factor of 29% versus a supply factor of 8% (almost the same ratio as a year ago).

The MICT SETA SSP (op. cit.) gives the following list of top 10 occupations with hard to fill vacancies in the MICT sector (and the quantity needed).

- Software developer (1131)
- Computer Network and Systems Engineer (352)
- ICT Systems Analyst (316)
- Programmer Analyst (165)
- ICT Security Specialist (150)
- Business Analyst (126)
- Multimedia Designer (121)
- Advertising Specialist (106)
- Database Designer and Administrator (91)
- Telecommunications Network Engineer (91).



The SSP comments that there is an increased demand for employees to be multi-skilled and that the employment opportunities tend to be for high-skilled professionals. MICT SETA identifies the change drivers as:

- Digitisation and convergence
- Analytics and Big Data
- Information Security
- Cloud Computing
- Internet of Things

As we shall see from our respondents, in the short time since they compiled their SSP, new drivers have arisen.

OTHER SETAs

As previously, we have reviewed each SETA’s SSP to establish any references to skills relevant to the ICT job roles. Not all SETAs publish updates to their SSPs with any regularity and several fail to make the latest edition available through their web sites. This exacerbates the paucity of comprehensive and current data needed by skills development policy makers and talent managers across the board.

AGRISETA

The 2017-2018 SSP (AgriSETA, 2016) has no specific mention of ICT roles, beyond including Information Technology in the table of Top Emerging Skills and Future Demand Needs (P.34).

BANKSETA

Banks are one of the larger employers of ICT skills, outside of the MICT sector. The Banking Sector Skills Plan 2017/18 (BankSETA, 2016) is the same version we reported on in 2017 and includes the following in the Foreword:

BANKSETA has identified the following five strategic focus priorities to which relevant projects are implemented and the sector skills needs are appropriately aligned in the SSP:

- *Regulatory compliance*
- *Changing Customer expectations*
- *Digitisation and technology including Data Management*
- *Risk Management with a key focus on cyber-security*
- *Management and Leadership with a key focus on business modelling and managing change*

With two of the five priorities focused on technology, it follows that much of the BankSETA SSP will refer to the skills needed to implement technological innovation. We will not repeat everything we included in our 2017 report. What follows is a reminder of the highlights.

“CHANGE DRIVERS

“The fourth industrial revolution is at the heart of five key drivers of change impacting the banking sector. The five major change drivers this discussion will focus on are: Digitisation and Technology; Changing Customer Expectations; Cybercrime and Risk; Disruptors in Banking and Economic and Political Uncertainty.

“DRIVER 1: DIGITISATION AND TECHNOLOGY

“Technological innovation is revolutionising the banking industry. There is no getting away from the fact that banks are under threat unless they can keep pace with technology. Some of these innovations are great for banks. Cloud computing, for example, can reduce costs and promote low-cost innovation. But some advances disrupt banking in a big way, like crypto-currency Bitcoin, which skips banks in the payment process. The four technological advances that are changing the face of banking, for better or for worse are social media, mobile banking, cloud technology and crypto-currency.

“DRIVER 2: CHANGING CUSTOMER EXPECTATIONS

With ready access to information, influence of online retail experiences and adoption of new technologies, customer expectations are rapidly changing. This is driving a shift in the market and forcing organisations to develop new interaction models that deliver deeper personalised service and improved customer care.

“DRIVER 3: CYBERCRIME AND BROADER FINANCIAL CRIME RISK

“The IT systems of the banks are now the focus of determined criminals who can transfer millions of pounds (or indeed any currency) within seconds to different accounts and move money across jurisdictions and borders with a few strokes of a keyboard. With IT systems of the larger banks under scrutiny for failures and inadequate controls, it is open to question whether the level of security and infrastructure will be sufficiently robust to withstand the challenge of cyber-crime. To improve cybersecurity, banks will be forced to devote greater resources to enhance the security, vigilance, and resilience of their cybersecurity model.

“DRIVER 4: DISRUPTORS IN BANKING

“Large retailers are entering the payment and Digital Wallet Market.

“The second disruptors are telecommunication companies.

“The third disruptors are internet giants, like Google, Amazon or PayPal.

“CONCLUSION

“By 2020, the Fourth Industrial Revolution will have brought us advanced robotics and autonomous transport, artificial intelligence and machine learning, advanced materials, biotechnology and genomics. These developments will transform the way we live, and the way we work. Some jobs will disappear, others will grow and jobs that don’t even exist today will become commonplace. What is certain is that the future workforce will need to align its skillset to keep pace.”

In the list of top banking sector vacancies that arose 2012-2014, Application Development Manager, ICT Systems Analyst and Systems Administrator stood out from the banking and general business roles. BankSETA included a table of IT Skills that are hard to fill, based on a 2015 survey:

Table 10: IT Skills that are Hard to Fill

Source: BANKSETA 2015 Survey

OFO Code	Occupation	Why are these hard to fill?
133101	Chief Information Officer	Big demand for these skills across all industries
251201	Software Developer	Big demand for these skills across all industries Sought-after skills which are in high demand
252901	ICT Security Specialist	Big demand for these skills across all industries
252101	Database Designer and Administrator	Big demand for these skills across all industries
251101	ICT Systems Analyst	Sought-after skills which are in high demand. Limited availability in the market which makes them costly to recruit Big demand for these skills across all industries Scarce skill, EE requirements They are highly demanded in the market
252201	Systems Administrator	Scarce skill, EE requirements
251202	Programmer Analyst	Some candidates meet our EE requirements · Large premium to be paid (>50%) Big demand for these skills across all industries
251203	Developer Programmer	Sought-after skills which are in high demand Big demand for these skills across all industries
351201	ICT Communications Assistant	Scarce skill, EE requirements

It is obvious that the supply of many of these critical skills falls far short of the demand across the economy. The BankSETA SSP (op.cit.) presents a number of other tables listing the predictions for skills needs over the next 5 years, the skills that are imported and the scarce skills. They note that new technology has brought about an increased demand for skills in the industry and quote the University of Cape Town Financial Sector Assessment Report (2014) which stated that in the South African economy there is a massive deficiency of Information Technology skills. These include hybrid roles such as Business Architects and Business Analysts, and there is also a growing need for Digital Managers. It has also been reported that the following Information Technology roles in companies within the financial services sector are in demand:

- JAVA Developers;
- COBOL Developers;
- IT Project Managers;
- SAP Developers;

- Software Developers;
- Systems Analysts;
- Systems Developers;
- Systems Architects;
- Analyst Developers; and
- Information Architects.

The following table is the list of Scarce Skills in the Banking sector, by OFO Code:

Table 16: Scarce Skills

Source: BANKSETA 2015 Scarce Skills Survey

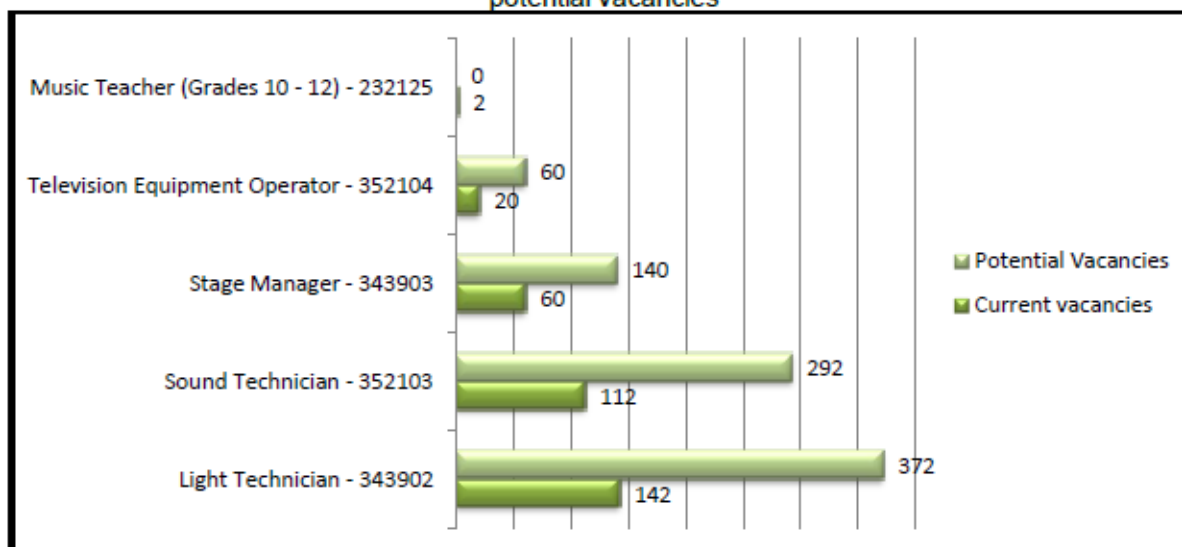
OFO Code	Occupation
251201	Software/Programmer Developer
252901	ICT Security Specialist
252101	Database Designer and Systems Administrator
251101	ICT Systems/Programmer Analysts
241202	Investment Manager/Analyst
121103	Credit Manager
242207	Compliance Officer
212103	Statistician
241102	Management Accountant
243402	ICT Business Development Manager

They also observe that Data Analytics has been identified as a major future development area for the sector as companies have large quantities of consumer data where the ability to identify trends and develop innovative solutions from that data is required. It has been reported that this area has suffered most due to the dearth of Statisticians in South Africa.

CATHSSETA

There has been no new SSP information since the 2014-2017 update to the SSP (CATHSSETA, 2015) which does not mention ICT skills, although there is a possible overlap into the roles of TV equipment operators, sound and light technicians with the Electronic Media & Film sub-sector of the MICT SETA (see graph below).

Figure 27: Top 5 vacancies in the Arts, Culture and Heritage sub-sector in terms of current and potential vacancies



Source: CATHSSETA SMS 2014

CETA

The Construction Sector SSP (CETA, 2017) includes the following reference to technology:

2.2.1 Technological Advances

The world is increasingly moving towards a more digitised world. The advent of technologies such as the internet of things is changing how society engages with the world. The change in traditional building methods is fast changing with developments in construction such as “Offsite construction” gaining ground as an alternative building method that offers the benefits of reduced construction time, less waste and possible cost savings. Building Information Modelling (BIM) has been a growing trend for years, as it is no longer relegated to just the largest firms but is seen as providing tangible business benefits such as more consistent, more accurate and less time consuming project document generation.

Building and Construction Industry (and its professionals) require advanced skills to cope with and optimally utilise technological advances in the industry, such as off-site prefabrication, laser scanning, 3-D printing, dry walling and projector plastering. A few recently completed projects in South Africa utilised these technologies such as the SANRAL building, Diepsloot housing project and the CellC JHB campus at Waterfall Business Estate. It will require from institutions of learning to be at the forefront of technology and impart such knowledge to young people studying to enter the construction sector, either as professionals (architects, quantity surveyors, engineers) or in management (project managers, planners and schedulers, quality assurance specialists).

CHIETA

The Chemical Industries SETA SSP (CHIETA, 2017) contains only one specific mention of ICT skills. They include Software Developer in their “hard to find” list.

EWSETA

The Energy & Water SETA SSP for 2017-2022 (EWSETA, 2016) has no mention of ICT skills.

ETDP SETA

The ETDP SETA issued a Schooling Sector Skills Plan update (ETDP SETA, 2018). They include Computer Applications Technology Teacher (Grade 10-12) in the list of top scarce skills.

We also quote the following references to the use of technology in schools and the teaching of STEM subjects:

2.3.5 Technology

Digital Learning is under consideration by the DBE, there are currently 130 000 of the 413 067 teachers trained in the usage of computers in the basic computer skills and software. However, more than 80% of schools have the infrastructure to roll out digital learning but most teachers are not equipped to use it, according to a study commissioned by one of the publishers has found (SAPA: 2014). The usage of technology will contribute in advancing the interest of learners on the ICT, although electricity is a source of concern in some schools. www.sapa.co.za: Accessed 13/06/2014.

The Department of Basic Education has made some progress with regards to the use of technology within its libraries but has fallen short of its targets. The e-Education programme through the Department of Basic Education Library and Information Systems initiative has been rolled out to various provinces, with varying degrees of success due to lack of sufficient funding and trained personnel.

2.5.11 Mathematics, Science and Technology Education

Mathematics, Science and Technology has proven to be fundamental in influencing any country's economy direction. However, South African research and reports indicates poor learner performance and achievement in both mathematics and science, an issue that has caused alarm among various key stakeholders in the country.

In 2015 a new Conditional Grant, namely the Mathematics, Science and Technology (MST) Grant, intended to promote the teaching and learning of Mathematics, Science and Technology in schools was introduced. According to DBE Minister (Basic Education Budget Vote Speech for the 2016/17 Financial Year) the 2015 MTEF allocation for the MST Grant stood at a total of R1.1 billion, which increased to R1.156 billion over the 2016 MTEF period – an increase of 5.1%. The 2016/17 allocation for MST Conditional Grant is R362.444 million; which will increase to R385.145 million and R407.483 million in 2017/18 and 2018/19 financial years, respectively. The MST Grant will continue to strengthen the implementation of the National Development Plan and the Action Plan to 2019 by increasing the number of learners taking Mathematics, Science and Technology subjects, improving the success rate in the subjects, and improving teachers' capabilities in teaching these three gateway subjects. The MST Grant will continue to focus on the provision of ICT resources to schools and training of teachers especially at Senior Phase and Technical Schools during the MTEF periods.

On 6 May 2015 during the DBE Budget vote speech for the 2015/16 financial year, the DBE deputy Minister acknowledged that much more still needs to be done with regards to improving learner participation and success rate in the Mathematics, science and technology. Thus, as part of the strategy to increase learner participation and performance in the MST, the DBE has developed the Mathematics, Science and Technology (MST) Sector Plan pronouncing national and provincial targets. The targets are deliberately intended to increase the number of learners taking Mathematics in order to meet the National Development Plan (NDP) targets of increasing the number of learners eligible for bachelors programme with Mathematics and Science to 450 000 by 2030.

According to DBE, the setting of targets revealed that there were schools in the country that had dropped the offering of Mathematics in preference to Mathematical Literacy. Through the various interventions the number of schools not offering mathematics has drastically been reduced, with many of the schools already reintroducing mathematics. The DBE has invested in the development of the DBE Cloud. Digital curriculum content development initiatives which were completed in 2014/15 and uploaded on the DBE Cloud included 24 Foundation Phase interactive workbooks for Numeracy and Literacy, 120 textbooks titles of Mathematics, Natural Science, and Technology as well as other multimedia resources.

FASSET

The FASSET SSP update (FASSET, 2017) for the financial and accounting services sector includes several references to ICT skills, as would be expected. Under "Change Drivers in the Sector", they include Developments in Technology, with the following comments:

“Developments in information and communication technology have had and continue to have a profound effect on the work of professionals in the Fasset sector. It has, in many respects, made their work easier – for example accounting software has simplified the work of accountants (Attolini, 2014) and SARS’s online tax platform has simplified the work of all tax practitioners. However, accountants, auditors and many other professionals in the financial field need to stay abreast of changing technology and the associated business risks. At the same time they need to advise their clients on how to manage the risks and apply new skills to use technology effectively.

“Data security is becoming a crucial issue and all businesses have to introduce additional measures and controls to safeguard data security and to ensure statutory compliance with the manner in which information is collected, stored, used and destroyed. This drives the need for information technology professionals and technicians in the sector.”

After Accountants and Auditors, ICT Professionals are the occupations most in demand, with almost 600 (down from 1 000 in the previous update) requirements identified in roles including programmers, analysts and managers. If we add together the similar roles of programmer analyst, developer programmer, software developer and applications programmer, they constitute half of the ICT occupations in demand in this sector. 21 ICT occupations have been identified as suffering shortages in 2017.

FOODBEV SETA

There is still no update to the information shown in the 2012 report, which indicated the need for ICT Project Managers (25), ICT Support Engineers (85) and Systems Analysts (315) over the five year period to 2016. The 2017/18 Scarce Skills List for the food and beverage industries no longer mentions ICT related skills.

There is a comment on ICT, as follows: *The consolidation in the sector and the imperatives of reducing operating costs have encouraged the installation of interconnected local networks among large companies, as support for strategic decision making. The need for greater efficiency in internal processes (production, supply chain management, administration, marketing and sales etc.) and the integration of internal processes with external organisations are other factors that drive the increased adoption of information and communication technology (ICT) solutions in large firms. Increased emphasis on packaging processes, the control of quality in HACCP and product quality makes ICT increasingly important.”*

FP&M SETA

FP&M SETA last published their SSP (FP&M SETA, 2016) in 2016 for the period 2016=2021. There is no specific mention of ICT roles beyond including “Information Technology expertise” in the top 10 critical skills list.

However, they do provide the following commentary on the impact of technology in their sector:

Technological developments do not have a uniform effect on the demand for labour. On the one hand, the mechanisation and computerisation of processes may reduce the demand for labour. At the same time technological changes are the biggest drivers of skills demand in the sub-sector and all levels of workers have to continuously upgrade their skills if they are to keep up with technological changes. The use of electronic media is increasing at a rapid rate and is expected to change the face of the printing and publishing sub-sectors locally and internationally. Paper products used for communication purposes such as newspapers are under threat from digital technologies and have dropped substantially over the past few years. This has meant that the pulp & paper sector innovate and look to develop alternative niche markets such as cellulose in cigarette filters, absorbent wipes and stabilisers.

The importance of social media has grown globally. “Social media has emerged as one of the more important channels in the online discovery, research and purchase processes” (Indvik, 2012). Social networks are a huge source of consumer data that can be used effectively, but these sources have been underutilised so far. Some of the implications that the SETA should consider are the role of social media in changing the way that companies

do business. For example, can blogging affect the bottom line or share price of a company and to what extent? Ideally, social media should be incorporated into the strategy of any business including that of the SETA.

HWSETA

There is no mention of ICT skills in the 2017 update to the Health & Welfare SSP for the period 2016/17-2021/22.

INSETA

The INSETA SSP published in 2017 (INSETA, 2017), as with the banking and financial services sectors, indicates that technology has become a significant change driver for insurance companies. They mention that developments in technology, transformational technology and sophisticated and universal technologies are changing the ways that humans interact with each other and creating floods of information...

“Key trends include Big data, automated underwriting, and technology in marketing, sales and service provision.” However, they caution that the insurance sector needs “an influx of technological talent” to translate the opportunities into operation.

The INSETA “hard to fill vacancies” include Java/Oracle Developer and Business Analyst, with Developer/Programmer (OFO Code 2015-251203) in their Top 10 Scarce Skills Occupations.

LGSETA

The LG SETA published a SSP update for 2018/19 (LG SETA, 2017). The SSP has the following to say about technology in local government operations:

4. Technology

Technology is a ubiquitous driver of change in almost every facet of the economy. In local government, the adoption of new technologies has been variable. The bigger metros have introduced new technologies in the delivery of municipal services in areas such as water and electricity metering. Other uses include electronic billing, notices of service interruptions, etc. Apart from customer interfaces, the role of technology in modern municipal infrastructure is likely to gain importance as ageing equipment gets upgraded and replaced. This is discussed further below.

One of the most important skills implications of the ever-increasing role of technology is that the minimum skills requirements in many occupations are increasing. The use of technology in a function increases the minimum skills required to participate in that occupation. This poses an on-going risk for the number of poorly educated unemployed, whose number of entry level occupations is decreasing.

MERSETA

The merSETA SSP update for the period 2017/18-2021/22 (merSETA, 2017) introduces reference to Advance Manufacturing and Future Skills in the context of Industry 4.0. They say:

The notion of manufacturing 4.0, future skills and advanced manufacturing has been the rhetoric and front of mind concepts for a couple of years. Frightening statistics are reported such as those of disruptive labour market changes, including the rise of robots and artificial intelligence resulting in job losses numbering in the millions. However, amongst all the chaos, the South African government along with research councils and higher education institutions have been investing time and energy into research to promote skills alongside technological advances, particularly in advanced manufacturing and create a substantial number of new jobs and preserve older jobs through up skilling and reskilling initiatives.

These new curricula must account for broad areas with respect to: predictive analytics, artificial intelligence, additive printing, the internet of things, nanotechnology, automation and robotics.

Professions in the future will centre on the following types of jobs: registered nurses, motor manufacturing technicians, wind turbine service technicians, flexible app developers, tourism and hospitality professionals, computer programmers, artificial intelligence and robotics specialists, and cloud computing specialists.

MQA

The SSP for the Mining Qualifications Authority (MQA) published in August 2016 (Mining Qualifications Authority, 2016) for the 2017-2018 period contains no comment on the ICT skills issues but does include several relevant occupations in the table of scarce skills (see the following table). The numbers of vacancies are relatively low but it is significant that the employers regard the skills for the listed occupations as scarce.

We recommend review of the use of OFO codes that differentiate between telecommunications occupations

Table 23: Scarce skills by vacancy

Occupation	OFO code	Alternative title/s	Total vacancy	Total employed	Vacancy intensity
Diamond and Gemstone Setter	661302	Jewellery Setter	51	127	40.16%
ICT Communications Assistant	351201	Computer Help Desk Operator, ICT Systems Analysis Assistant, ICT Communications Assistant	15	38	39.32%
Special Forces Operator	542203	Team Leader	5	17	29.85%
Telecommunications Technical Officer or Technologist	352201	Engineering Technician (Telecommunications)	4	16	25.64%
Telecommunications Line Mechanic	672204	Telecommunication Electrician	1	4	24.27%
Seismologist	211402	Geophysicist, Geophysical Scientist	4	19	21.02%
Ship's Master	315201	Deck Officer, Harbour Pilot	1	5	19.23%
Rock Engineering Manager	132203		7	39	17.91%
Psychometrician	263409		1	6	17.61%
Accountant	241106		1	6	16.45%
Legal Executive	341102		2	13	15.69%
Engineer Soldier	542305	Engineer Officer	1	7	13.89%
Ship's Officer	315202		1	7	13.74%
Telecommunications Network Engineer	215303	Communications Specialist (ICT), Communications Consultant	1	7	13.51%
Occupational Social Worker	263507	Adoptions Worker	4	38	10.53%
Computer Network and Systems Engineer	252301	Applications Developer, Systems Engineer, Computer Network Engineer, Network Support Engineer	11	123	8.91%
Employee Wellness Manager	121205	Employee Wellness Consultant	1	12	8.40%
Bricklayer	641201	Bricklayer (Refractory and/ or Chemical), Bricklayer (Refractory), Bricklayer and Plasterer	10	123	8.16%
Electronics Engineer	215201	Instrumentation Engineer, Information Engineer	6	79	7.64%
Electrical Engineer	215101	Control Engineer, Electrical Engineer (Mines)	25	352	7.11%
Goldsmith	661301	Jeweller, Jewellery Chainmaker (Hand Made), Designer Goldsmith	52	784	6.63%
Developer Programmer	251203	ICT Programmer, ICT Developer, Applications Developer	3	47	6.40%
Dentist	226102		1	17	5.92%
Automotive Motor Mechanic	653101	Auto Engineer/Mechanic, Automotive Fitter, Automotive Mechanic, Mechanical Service Advisor (Vehicles), Motor Mechanic	12	218	5.50%
Transportation Electrician	671208	Auto Electrician, Locomotive Electrician	37	738	5.02%
Electronics Engineering Technologist	215202	Instrumentation Technologist, Information Technologist, Computer Engineering Technologist	9	180	5.00%

Source: Calculated from Weighted MQA WSP/ATR Submission, 2016

listed in the table. The granularity may be disguising the common characteristics of the job functions, making it more difficult to recruit appropriately skilled workers than is necessary.

PSETA

The most recent SSP for the public service sector is the PSETA SSP Update for 2015-2016 (PSETA, 2014). They include the following information, relevant to ICT skills:

The highest vacancy rate in any major occupational category is 21,4% for information technology personnel (2014 data), with 564 vacant posts. Of these 34 are for computer programmers, 108 for computer system designers and 422 for “other” information technologists. It would be useful for PSETA to share more details of these requirements with MICT SETA.

To put the 564 posts into context, the vacancy rate for “professionals and managers” in the sector is 15,6% but this represents more than 40 000 vacant posts.

SASSETA

The SASSETA was placed under administration in 2015 and has not published an update to the SSP since the 2013 edition (SASSETA, 2013). That edition made the following comment about technology:

“Rapid changes in technology have an impact on most sectors, For example, the introduction of the IT security. From a skills development perspective, the industry should be prepared to effectively deal with technological changes and innovations.

The introduction of technological changes are introduced primarily to enhance the effectiveness and to increase efficiency of the security, for instance; to detect cybercrime. With all business striving to increase margins, the introduction of technology often results in more efficient operations with reduced staff.”

The SASSETA 2013-14 update to the SSP (op.cit.) lists the following as scarce and critical skills:

Scarce skills:

Defence fraternity: Cyber Crime Investigators

Justice fraternity: IT Security Specialist

Policing fraternity: Cyber Crime Investigators

State Security fraternity: Network Specialist, Information Security

Organised labour: Information Communication Technology Specialists

NGOs: IT Specialist

Critical skills:

Corrections fraternity: IT (system developer, business analyst and Information Security)

Legal fraternity: IT Skills/ Cyber Law

Policing fraternity: Computer skills, IT Skills

State Security fraternity: ICT Training Skills, Cyber Crime Investigation Skills, Business Analyst Skills

Organised labour: IT Specialist

There is no quantification of the needs.

SERVICES SETA

The Services SETA SSP for 2017/18 (Services SETA, 2016) contains significant comment on the impact of technology on some of the sub-sectors covered by the Authority.

“In the real estate industry, technology has had an impact on the design, form and nature of interaction between sellers and buyers of property on the one hand, and/or between rental agent and lessor, on the other, as more people turn to various websites and applications (Apps, as they are commonly known) to access, compare and utilise information. This has necessitated that real estate agents and property management agents use

technology to provide high quality and useful information to increase traffic to their websites and Apps in order to facilitate sales. The implication of such a trend is that real estate agents and property managers not only require information about the product that they are selling but they now need to have knowledge about brand management, digital sales, marketing and social media. Another consequence of technology for service businesses is that companies, now more than ever before, have access to more data about their customers. This 'big data' requires that managers and professionals acquire higher levels of analytical skills to use data strategically.

"Marketing services enterprises in South Africa need to operate within the ambit of the Consumer Protection Act of 2011, which places stringent requirements to protect consumer information during marketing activities. Generally, technological developments place new demands on organisations while, at the same time, providing them with new opportunities for improving activities and products. ... Research participants highlighted that a major trend was the shift to digital marketing, with increased use of social media, and their integration into traditional marketing activities.

"General consulting services benefit from advancements in technology in two ways, namely, increased flexibility for work to continue outside of the traditional work hours and work outputs which are increasingly computer-generated. Skills in the use of information technology (IT), including social media for desktop and online research, will be increasingly needed to ensure that firms become competitive.

"Changing consumer preferences have brought about a demand for e-services in postal services around the world. The addition of information, communication and technology (ICT) infrastructure into post offices in rural areas is a major step forward in bridging the divide between urban and rural areas. It is anticipated that postal services will benefit from being able to connect users to broadband services and thereby encourage adoption of digitised mail for the revival of postal services. Auxiliary services such as parcel delivery and logistics may also be launched off a wider broadband infrastructure which will enable technology to connect people to goods as well as reinvigorate postal services by shifting revenue generation to logistics and parcel delivery. Skills needs in this sector include IT and logistics. The Services SETA is currently conducting value chain research to further unpack the skills implications for the sector. The findings of this research will be integrated in the 2018/19 SSP update.

"Firms in the marketing services industry recognise that smart phones are a game changer. These devices bring the firm closer to consumers and open new marketing opportunities.

"In the contact centre environment, in as much as technological trends are concerned, the emergence of speech analytics and call categorisation is creating greater efficiency and control over quality of work. Research participants also highlighted that the contact centre industry was seeing higher levels of automation of certain tasks and with customers becoming more technologically savvy, there was a growing trend in the reduction of the number of contact centre call agents. Cloud technology is empowering customers to access services and this is resulting in more cost-effective service delivery by clients to customers. It was highlighted that the SETA needs to be designing and delivering more qualifications to meet the need of labour services in the sector. It was noted that currently the only qualification associated with contact centres was Workforce Planner and yet there are other qualifications needed such as: Contact Centre Agent, Team Leader/Supervisor, Contact Centre Manager/Executive, Quality Assurer/Coach/Assessor and Management Information Systems Manager.

"Participants highlighted the fact that technology was having a significant impact on business operations as well as on how customers engaged with the funeral services sub-sector. For example, it was emphasised that some enterprises were developing a strong online presence to manage most of their business operations from appointment scheduling, to viewing products (e.g. caskets), or booking and managing customer relations using social media."

Extracts from Tables 20 and 21 of the SSP show ICT roles in both scarce and critical skills categories:

Table 20: Services SETA Scarce Skills, 2017/18

26	2015-251101	ICT Systems Analyst	ICT Systems Advisor, ICT Systems Consultant, Internet Consultant / Specialist, ICT Business Systems Analyst, ICT Systems Strategist
27	2015-251201	Software Developer	Software Designer, ICT Risk Specialist, Information Architect Software, Software Engineer, Software Architect
28	2015-251301	Multimedia Specialist	Digital Media Specialist, Digital Media Specialist, Multimedia Programmer, Multimedia Developer, Graphical Programmer

Table 21: Services Sector Critical Skills

#	Critical Skill	Demand sub-sector originator
ICT		
1	Internet skills,	Real Estate
2	Database Analytics	Real Estate
3	Social media	Multiple sub-sectors
4	Computer Literacy	Multiple sub-sectors

TETA

The Transport sector's 2016/17 SSP update (TETA, 2016) mentions the following scarce skills in the top ten of two sub sectors:

- Aerospace: Telecommunications Engineers (OFO 215201) 200
- Freight Forwarding & Clearing: ICT Business Development Manager (OFO 243402) 200

The TETA SSP makes no further mention of specific ICT skills but does make the following comment on technological advances:

The transport sector (sic) will continue to have an impact on the transport sector directly to improve its efficiency and effectiveness. The development of the Hyperloop and magnetic levitation trains, autonomous vehicles and smart cars are some of the developments which will have an impact on the type of skills to drive the industry. Concurrently, the development and access to technology by communities will also affect how the transport sector is used. For the users, the development of technologies and trends in people's lifestyles will affect the way people use transport. Ease of connectivity between transport drivers and passengers, through smartphones and transport applications, is leading to ride-sharing services (e.g. Uber and Lyft). This technology is affecting how people use cars, the different skills that will drive the sector.

W&R SETA

The W&R SETA's SSP for 2016/2017 (W&R SETA, 2016) repeats the following paragraphs (P.27) from the previous edition:

In order for the Wholesale and Retail Sector to become efficient, effective and economical enough to maximise profit margins and customer experience, technological change is critical. The retail industry is in the midst of a consumer revolution. The key drivers of this revolution are the rapid adoption of mobile devices, digital media and tablets equipped with shopping applications. Wholesalers and retailers risk potential growth and development if they do not stay abreast of technology.

The type, level and mix of skills required by multi-channel retailing presents a challenge to the sector. The W&R SETA needs to focus skills development on initiatives such as learnerships that include new technologies and training in digital media, social networking and marketing. The skills development emphasis should include developing of talent pipelines to harness customer strategies.

Unlike the previous edition, this SSP has no reference to ICT skills beyond putting IT Skills Computer (Advanced) in 10th place of the critical skills list.

W&R SETA also repeated the comment from the previous year that *“Software developers are no longer just technical people – they now need to be both technical- and business-minded. This combination is difficult to find, and when they are found they are very expensive.”* (P.46)

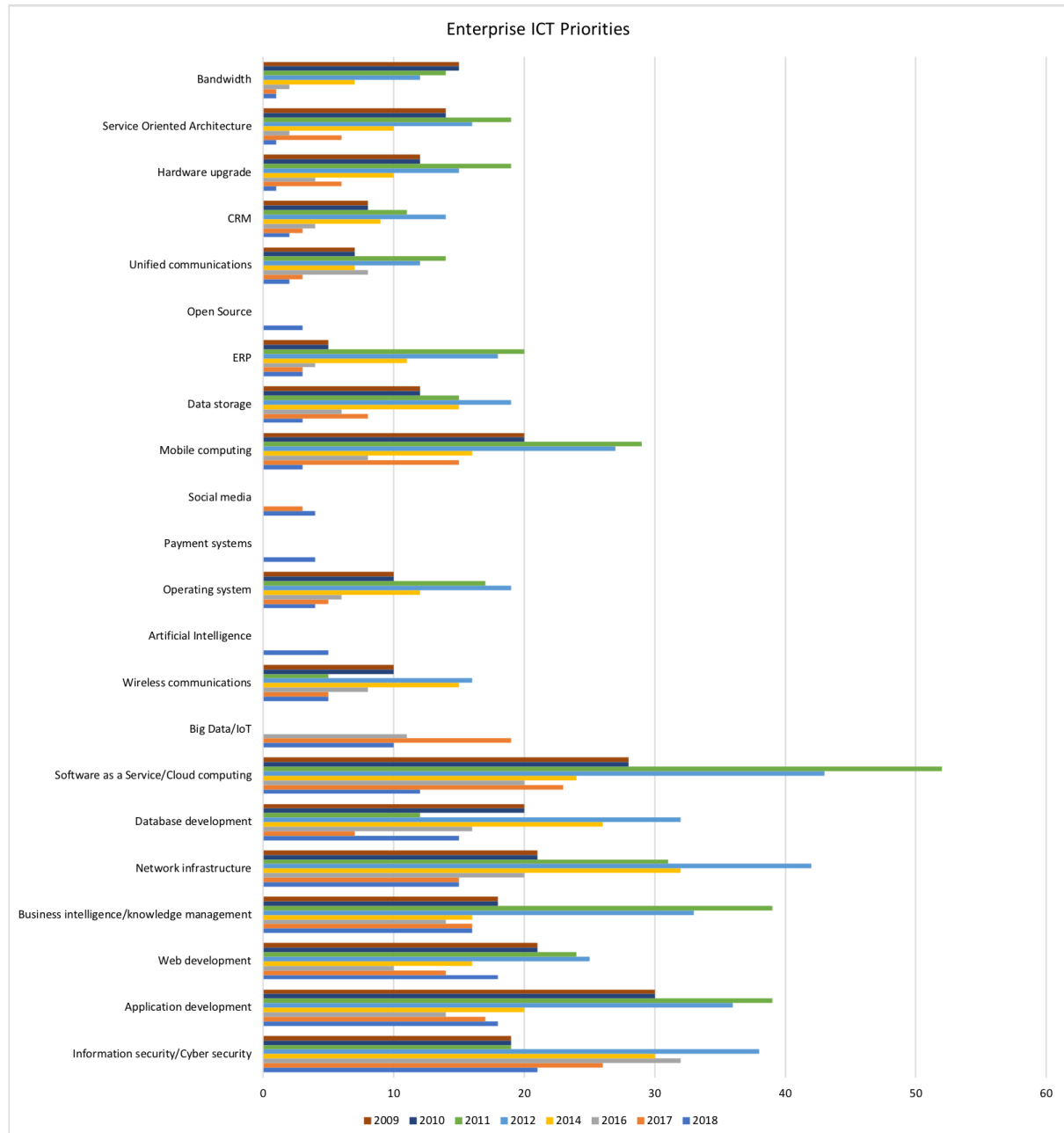
SECTOR CONSOLIDATION

As we noted in the Executive Summary, the lack of consistency in the approach and timing of the various Sector Skills Plans makes it very difficult to extract a holistic view of the demand for ICT skills nationwide. At the very best, the data is based on reports from levy-paying enterprises, leaving a large number of unreported needs from the mass of SMMEs found in many of these sectors.

ICT PRIORITIES

Our respondents continue to show a more muted view of their top ICT priorities, as indicated by the generally lower values of the 2018 (mid-blue), 2017 (orange) and 2016 (grey) “bars” in the graph. **Information Security** remains at the head of the pack, which is to be expected, given the number of “hacks” and “leaks” that are regularly reported globally and locally, and the increased legislative focus through POPI and GDPR.

2018 sees new entrants in the form of Artificial Intelligence, Payment Systems and Open Source.



The 2008 Survey identified the top 6 priorities overall, based on the selection of their own top 3 by each respondent. That analysis showed **Business Intelligence/ Knowledge Management** to be the top-ranked priority, followed by **Application Development** and **Software as a Service**. These were supported by Service Oriented Architecture, Web Development and Mobile Computing.

In 2009, the data was revised to include all identified priorities, and the chart showed that **Application Development** was that year's top priority, with **Business Intelligence/Knowledge Management** being pushed into third place by the entry of **Network Infrastructure** in second place. CRM, Information Security and the Operating System were the supporting cast, although there was little difference between many of these "other" priorities.

We thought that the emphasis on Network Infrastructure in 2009 reflected the realisation that effective broadband access is essential if enterprises are to benefit from the technology innovations becoming available.

The **2010** survey was revised to indicate what each respondent thought was their 1st, 2nd and 3rd priority for the coming year. **Application Development** retained its top spot for the second year, with **Web Development**, **Software as a Service** and **Business Intelligence/ Knowledge Management** just surfacing above several other contenders for the next most significant issues. We observed that the spread of interest among the second and third tiers of "priorities" indicated the wide range of challenges facing enterprise decision-makers who need to keep their information systems capable of delivering services that support the changing business needs.

We also commented that if we compare the changes over the three year period, we could see a significant drop in the importance of **Business Intelligence/ Knowledge Management** and a significant increase in the interest in **Web Development**. We felt the lowered interest in **Software as a Service** (SaaS) in 2009 seemed to have been an anomaly and this opinion was confirmed by the 2011/12 and 2014 results.

In **2011**, we showed the Priority Progression picture over the four years of the Survey. We could see that **Software as a Service** was definitely high on the agenda, albeit as a second priority, while **Application Development** was still the firm favourite as first priority. Managers continued to face a wide range of challenges in applying technology to support business needs and it is notable that **Mobile Computing** emerged from the "also ran" ranks in 2011. The popularity of tablet computers and "smart" phones was cementing the demand for the adaptation and implementation of systems that offer safe, secure and reliable facilities for mobile workers.

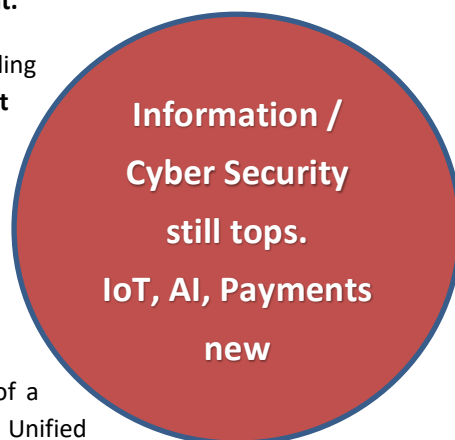
The **2012 results** follow a similar pattern to that established in 2011, with **Software as a Service/Cloud Computing** now leading the field. **Network Infrastructure** and **Information Security** move into second and third place respectively, pushing **Application Development** into fourth slot. However, the differences between these rankings are not great and we can add **Business Intelligence/Knowledge Management** and **Database Development** to complete the Big Six of priority issues in the year ahead.

In **2014**, the Big Six became the Big Five. The ranking of the top five priority areas remained unchanged from the previous survey – in descending order, they are **Software as a Service/Cloud Computing**, **Network Infrastructure**, **Information Security**, **Application Development** and **Business Intelligence/ Knowledge Management** (which now includes Big Data/Analytics). It was almost impossible to separate the next five areas of priority attention – they are: Database Development, Mobile Computing, Web Development, Data Storage and Operating System.

In **2016**, we were able to again identify six leading priorities. **Information Security** had become the clear leader, followed by **Network Infrastructure**, **Software as a Service/Cloud Computing**, **Database Development** and **Application Development**. Because of its growing profile, we separated **Big Data/Internet of Things** from the **BI/KM** category, and it now appears in seventh place. Had we left it combined with sixth place **Business Intelligence/ Knowledge Management**, this category would have been a close second to the highest priority.

Our **2017** results showed two “top” priorities, **Information Security** (still the leader) and **Software as a Service/Cloud Computing** (up from 3rd place in 2016). Then, there was a group of 6 priority areas that all received similar ratings from our respondents. They were: **Big Data/Internet of Things** (up from 7th place in 2016), **Application Development**, **Business Intelligence/ Knowledge Management**, **Network Infrastructure** (down from second place in 2016), **Mobile Computing** and **Web Development**.

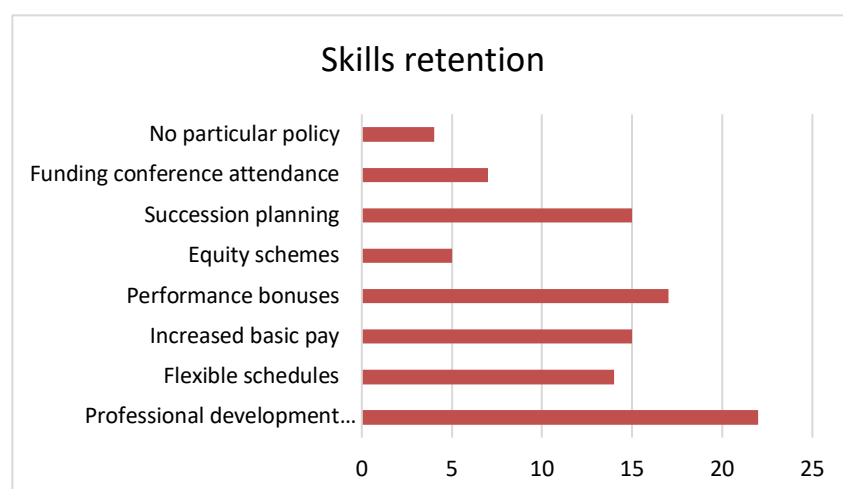
2018 reinforces **Information Security/Cyber security** as the leading priority, with familiar faces among the next group of five – **Development (Applications, Web and Database)**, **Business Intelligence/Knowledge Management** and **Network Infrastructure**. **Software as a Service/Cloud Computing** has retreated from its giddy heights of 6 or 7 years ago. Up-and-coming and newcomers include **Big Data/IoT**, **Artificial Intelligence** and **Payment Systems**. **IoT** and **Big Data** are also reported by Brainstorm’s *CIO Survey* as focus areas for CIOs.



Slipping out of the priority zone, as the technologies become less of a challenge and easier to implement are areas such as Wireless and Unified Communications, Operating Systems, Mobile Computing, Data Storage, Hardware, SOA and Bandwidth.

STAFF DYNAMICS

The demand for skills generally and for ICT skills in particular is subject to a wide range of influences. These include the depressed state of the economy, uncertain political stability, fallout from exposure of corruption and introduction of new and improved technologies. In this section, we look at the ways in which employers approach the skills pool conundrum.



The pattern of staff retention policies in 2018 is very similar to previous years. Performance bonuses and professional development programmes continue to lead the preferences, with flexible schedules, succession planning and increased basic pay grouped together. Funding of attendance at conferences appeared in this list for the first time last year. The low

incidence of equity schemes may provoke may indicate low impact of BEE legislation on transformation of ownership in the sector. Comments from respondents place the emphasis on developers and programmers as the toughest to retain.

There continues to be a mix of line managers and senior executives holding the responsibility for training, with the 2018 respondents moving away from last year’s equal share (just more than 20% each) between senior executives (C-level and Directors) and specialist HR. talent and training managers towards 35% at the senior level and 25% within the HR/training camp. JCSE suggests that line managers should be able to identify training needs among their teams but the responsibility for executing the training programmes should rest with a manager whose role is focused on this activity.

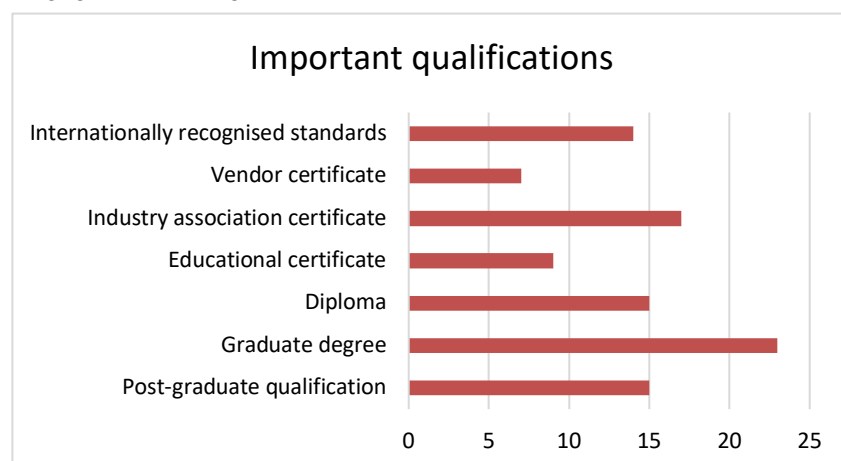
The percentage of respondent employers recruiting overseas in 2018 has slipped back to 21% (2017 29%; 2016: 26%, 2014: 12%; 2012: 18%). There continues to be a steady stream of applications for “critical skills visas” via

the South African embassies and consulates, as the country remains a desirable destination for ICT practitioners from some of our African neighbours and from India.

The level of respondents recruiting overseas indicates the continued paucity of locally available candidates with experience, combined with ongoing popularity of the “critical skills visa” as a key to medium term residence in South Africa.

CORPORATE PREFERENCES

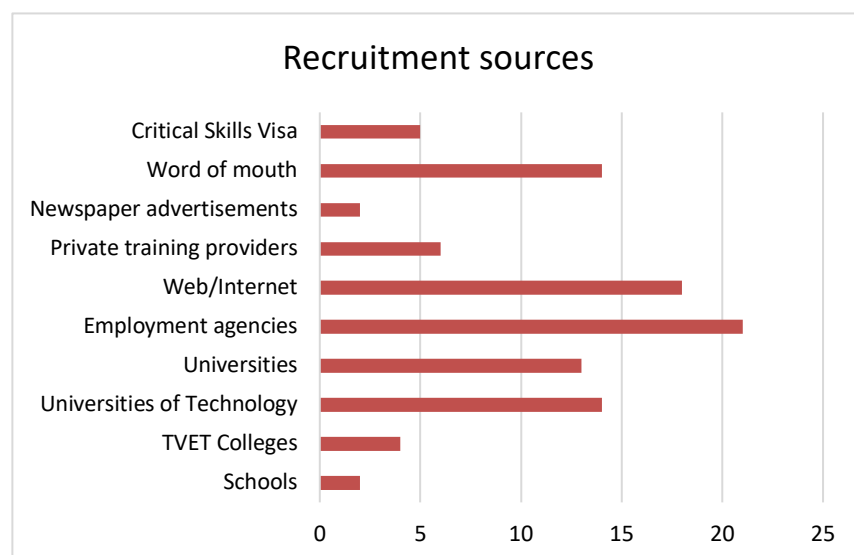
RECRUITMENT VALUE



Graduate degrees continue to be the top preference when setting recruitment criteria (as was the case in our last two reports). However, the move into second place of the industry association certificate indicates the growing recognition of assessment by professional bodies. Post-graduate qualifications and diplomas are still valued, as is the application of international

standards.

LOCAL RECRUITMENT



Since 2010, when this question was introduced, employment agencies are the most preferred source, except in 2010 and 2016, when on-line was at the top.

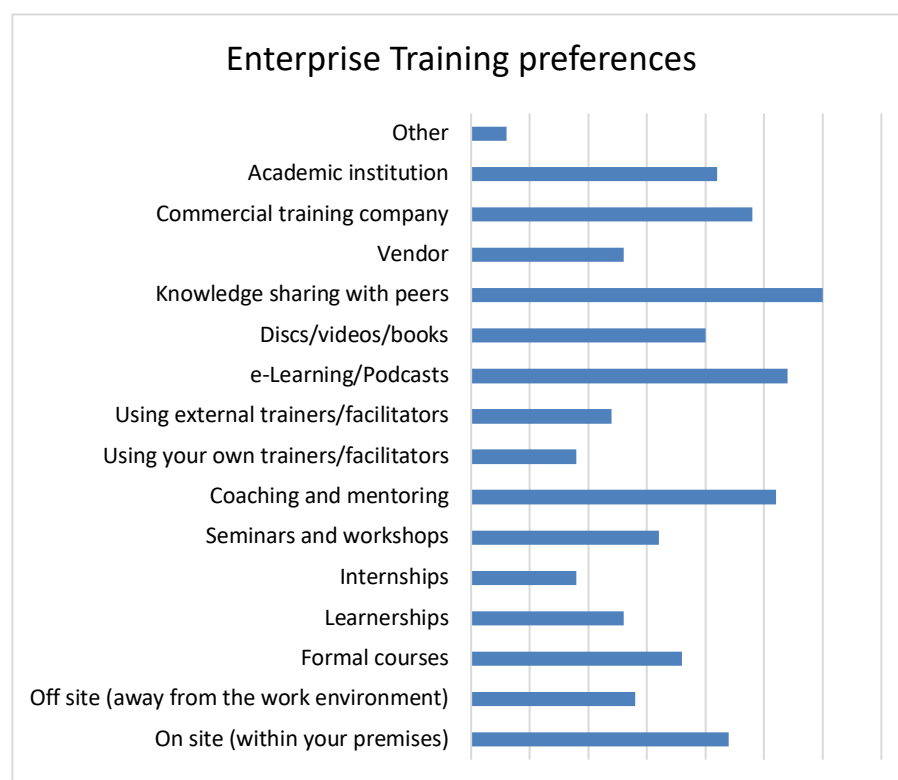
Last year, we added Word of Mouth to the choices and it remains high in the rankings, equal to the two University categories. However, online sources have taken second place in 2018.

This year, we added the Critical Skills Visa to the question and it clearly represents a small but significant source of skills.

Universities continue to head the choice of institutional sources, and it is encouraging to see the maintained popularity of the Universities of Technology.

Newspaper advertisements, private training providers, TVET colleges and schools have all shown declining popularity in the 2017 and 2018 Surveys.

TRAINING METHODOLOGIES



The pattern of preferences for skills transfer in 2018 from the employers' perspective is very similar to last year. Knowledge sharing, e-Learning and Coaching/mentoring remain the most preferred methodologies, underlining the approach that skills are best acquired in the workplace.

The indicators show relative preferences rather than hard numbers. Commercial training companies have attracted more supporters this year,

while formal courses have dropped back in popularity.

MANAGEMENT DEVELOPMENT

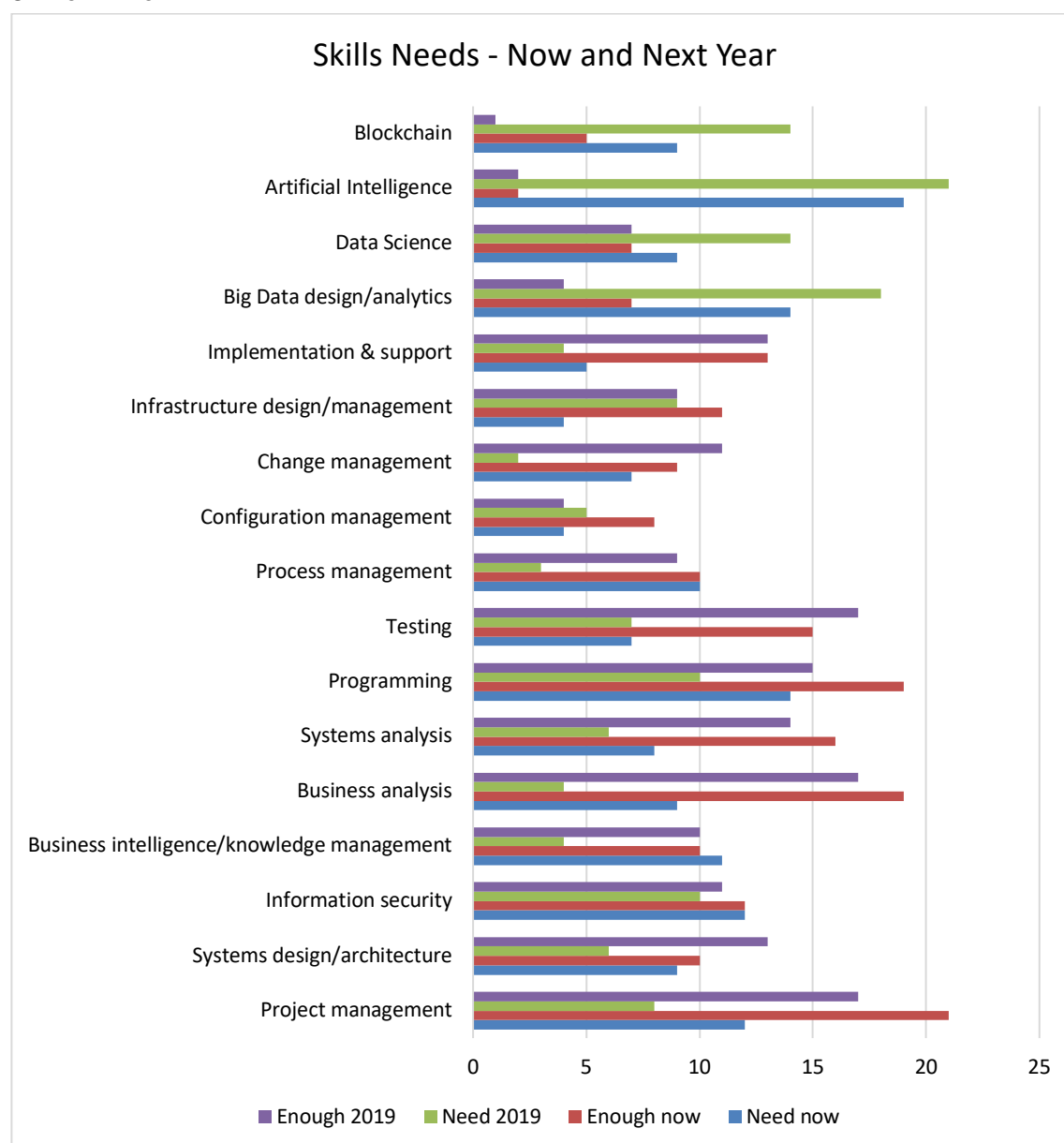


This year, mentoring and coaching have moved back in front of formal courses as the preferred approach to management development. The 2017 Survey indicated that formal management courses moved ahead of the other approaches to management training, with mentoring and coaching taking second and third places. In 2016,

mentoring was the preferred approach to management development, followed by continuing education and formal management courses. In the 2014 results, formal management courses took the lead from mentoring as the preferred approach to developing management skills, continuing the trend shown in 2012, when this approach moved from fourth to second place.

It is now three years since the appointment of the B-BBEE ICT Sector Council, and two years since the implementation of the Amended ICT Sector Code. The annual monitoring reports from the Council have yet to show significant progress in the development of Black managers in the sector. The 2018 report (B-BBEE ICT Sector Council, 2018) shows only a 50% achievement of the Management & Control targets.

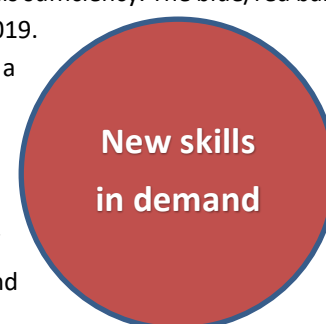
SKILLS NEEDS



This is an important chart, reflecting the balance between skills shortage and skills sufficiency. The blue/red bars indicate current demand and the green/ purple bars the anticipated state in 2019. Put simply, if the green and blue bars exceed the purple and red bars, there is a serious shortage in that skill group. If the ratio is reversed, the demand is less urgent, although the length of the green and blue bars indicates the level of demand.

At one extreme, **Big data design/analytics**, together with the new categories of **Blockchain**, **Artificial Intelligence** and **Data Science**, show high demand now and next year with low sufficiency for both periods.

At the other extreme, **Implementation/support** shows that significantly more respondents are satisfied with the supply of these skills than anticipate them being in short supply.

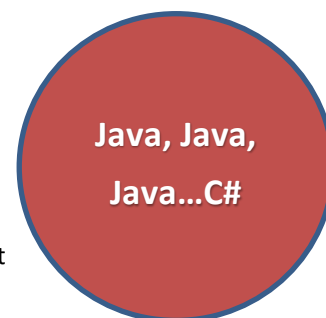


Current and future demand for **Programming, Information Security** and **Project Management** skills remain high.

The pattern of demand for programming languages in 2018 has not changed much. **Java** stays in the lead, followed by **C#** and **Python**. **.NET, C++, HTML** and **SQL** follow.

In 2017 was **Java** the clear leader and **C#** in second place, unchanged from 2016. **Python** moved into third spot, with **.NET** and **C++** tied for fourth. Of equal but lesser popularity, R, PHP, COBOL and Delphi all get mentioned.

In 2016 the leading languages were also **Java** and **C#**, followed by VB.NET and PHP. 2014 was very similar to 2012, with Java, C#, .NET, C++ and VB the most popular.



IMPACT OF SKILLS SHORTAGE ON BUSINESS

In continuing to track this opinion from our respondents, it is concerning that the proportion reporting a serious impact of the skills shortage on their business remains so high. In 2008, all respondents indicated that the skills shortage was having at least a major effect on their business. On average, the picture is slightly better since then.

In 2009, 75% still said that the skills shortage was having a major effect on their business. In 2010, the 75% shrank to 45%, suggesting that the demand for critical skills lessened significantly, perhaps because more suitable candidates were available. However, in 2011, more enterprises were again concerned about the skills shortage, with two-thirds reporting at least a major effect.

In 2012, there was another small improvement, with 60% of enterprises indicating that the skills shortage was having a major (or more serious) effect on their capacity and 40% (34% in 2011) showing that the effect was minor or non-existent. In 2014, this pattern continued, with a minor shift of 1% less in the major concern zone.

In 2016, the gap widened again with 71% reporting at least a major effect (including a high 29% indicating a threat to their viability). We repeated our 2014 comment that it was interesting that, in spite of the reduced level of economic activity, the skills shortage continues to impact management perceptions to this extent. Our findings were supported by the ITWeb Brainstorm CIO Survey (ITWeb Brainstorm, 2015), which showed lack of skills to be the second “top concern”, reported by 70% of respondents.

In 2017, the serious impact level returned to 75% of respondents, leading us to ask what would be the potential improvement in the ICT economy if the skills gap could be closed significantly – and, by extension, the contribution this would make to the country’s GDP. In 2018, we have a slightly more optimistic reading of 65% of respondents still concerned about the impact of the technical skills shortage on their business prospects.

In the same vein, the global economy effect has abated a little, with 36% of respondents indicating that it has made it harder to recruit (2017: 50%; 2016: 25%; 2014 – 12%; 2012 - 21%; 2011 - 34%). The same percentage (36%) indicate the economy is having no effect on recruitment (2017: 29%; 2016: 40%; 2014 – 53%).

CORPORATE SUMMARY

In 2011, we highlighted the need for greater cooperation between the SETAs in respect of ICT roles performed across the board. We thanked the MICT SETA for their efforts to facilitate this in 2012 but, six years on, we have to comment that there is no appreciable progress. It does not make sense that the collection of vital employment data continues to be disjointed and inconsistent. In 2016, we noted that the MICT SETA had embarked on a project to map the OFO codes to industry job roles and qualifications pathways. We have yet to see the results of the project which we hoped would improve the coordination between the SETAs, StatsSA and the

Departments of Labour and Higher Education & Training. We noted that the project revealed considerable confusion within the OFO codes relevant to the ICT sector and that the challenges of rationalising them must be addressed.

Overall, the ICT skills shortage continues to constrain South Africa's capacity to increase economic activity and create jobs. In spite of the welcome number of initiatives to bring technology into education, the ongoing failure of the education system to generate a cohort of young people who are familiar with technology and its application in daily life, who are interested in developing and implementing ICTs and who are work-ready when they exit from the system is unaffordable. We cannot continue to lament high unemployment rates among young (and not-so-young) South Africans if we cannot grasp the nettle of early skills development.

In 2017 we referred to continuing political uncertainty amid the escalating leadership battle in the ANC, a ratings downgrade, corporate failures in the fight against corruption and "state capture", delays in the migration to digital terrestrial TV and rolling out of broadband infrastructure. In 2018, we have seen some remarkable shifts in these areas, although they continue to be issues dominating the headlines. It is too early to rejoice that the new "lights" illuminating some of South Africa's dark places will lead to positive outcomes but there are encouraging signs. Much will depend on whether the promises made ahead of the 2019 elections are mere rhetoric or the foundation for real action.

Light at the
end of the
tunnel?

A cautionary note is sounded in the Brainstorm *CIO Survey*, that although three-quarters of CIOs cite lack of skills as one of their biggest concerns, more than half are also reporting that they are either restructuring/retraining or have frozen hiring in their enterprises. (ITWeb Brainstorm, 2017) Two of our major telecoms service providers have announced job cuts in September 2018. This highlights the dilemma facing South African decision-makers, knowing the vital necessity for ICTs as enablers of growth but lacking available investment resources.

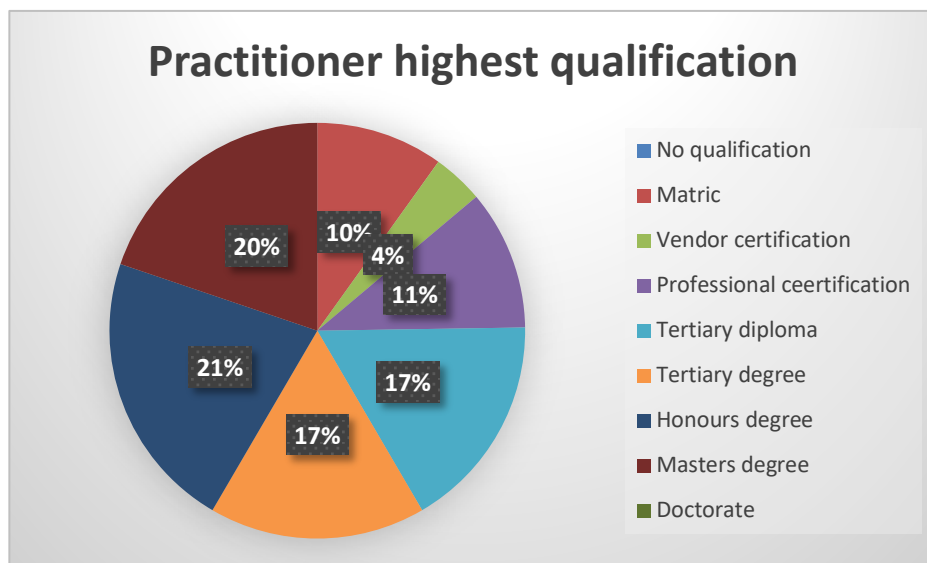
We were fortunate to be granted access to the CompTIA/ITWeb State of the IT Skills Survey 2018 results (CompTIA, 2018). This online survey of employers was carried out just before our research and complements many of the results from our respondents. Variances in emphasis arise from the profiles of the respondents, the questions posed and the answer choices.

PRACTITIONER RESPONSES

Our pool of practitioner respondents remains fairly constant in numbers and we are satisfied that the sample is large enough from which to draw valid conclusions. In this section of the report, figures in (brackets) are the 2017; 2016; 2014; 2012; 2011; 2010; 2009 results, respectively.

PRACTITIONER PROFILE

Our “average” practitioner respondent has changed a little in the last 11 years. He’s now in his early-30s (a little younger), lives in Gauteng, has more than 5 years’ experience (not quite as well established) but has only been with this current employer and in this current role for 3 years, working as a manager or a developer in a small to medium sized enterprise.

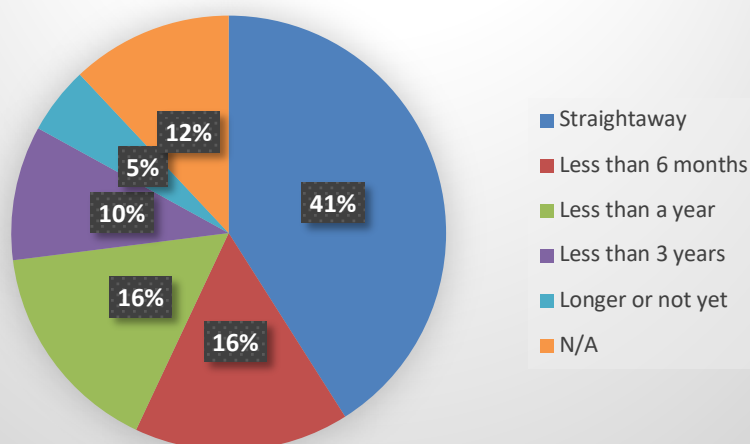


75% (80%; 80%; 70%; 68%; 68%; 64%; 47%; 66%) have a tertiary diploma or higher qualification (with 30% of them studying the field of Computer Science, down from 35% in 2017 and from almost half in 2016). 75% (87%; 69%; 69%; 68%; 69%; 43%; 70%) are living in Gauteng, 13% (7%; 16%; 16%; 16%; 16%; 47%; 16%) in the Western Cape, 4% (4%; 7%; 7%; 7%; 7%; 7%; 7%) in KZN.

The 2010 anomaly between Gauteng and Western Cape resulted from a particularly enthusiastic campaign for practitioner responses by CITI in that year. 8 Provinces were represented among the practitioners this year.

27% (22 %; 21%; 21%; 21%; 21%; 20%; 21%) of the practitioners who responded are female, a significant jump above the previously consistent level of 21% (+/- 1%). In view of South Africa’s pursuit of gender equality, we can hope this is a sign of progress but we will not go overboard with the celebrations until it is reinforced in our next survey. However, the generally low figure is not unique to South Africa, as this ratio is commonly found across the industry globally and has shown little signs of significant change for many years. We also noted a significant jump in the proportion of younger respondents in 2018 - hitting 17% (7%; 8%; 8%; 8%; 6%; 10%) of respondents being under the age of 25 – hopefully, an improvement in the low number of new entrants to the ICT sector in recent years.

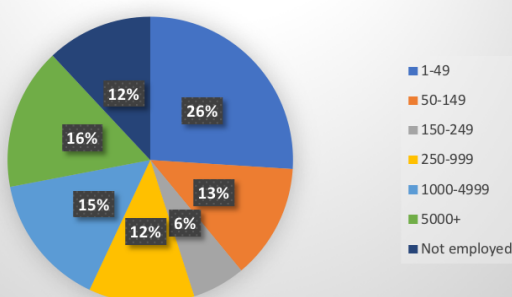
Delay in obtaining employment



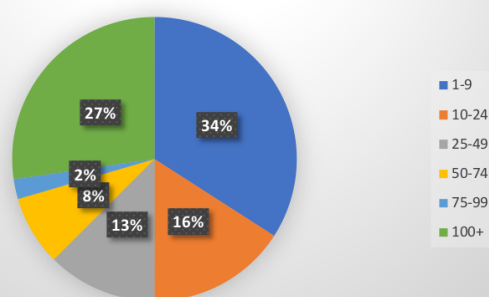
We inserted this question into the JCSE-IITPSA ICT Skills Survey in 2016, asking practitioners how long it took them to become employed, after they had completed their studies. Down from 2017's figure (55%), only 41% were employed straightaway. A further 16% (10%) found a job within 6 months and another 16% (7%) within a year. From the job-seekers' viewpoint, it can be argued that 31% (25%) of potentially qualified entrants failed to find work

within 6 months – almost one-third of them. This reinforces last year's suggestion that either the applicants are not work-ready or that employers are not sufficiently willing to engage inexperienced staff.

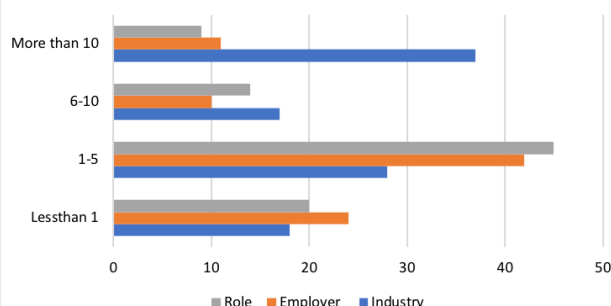
Size of employer



Size of IT dept

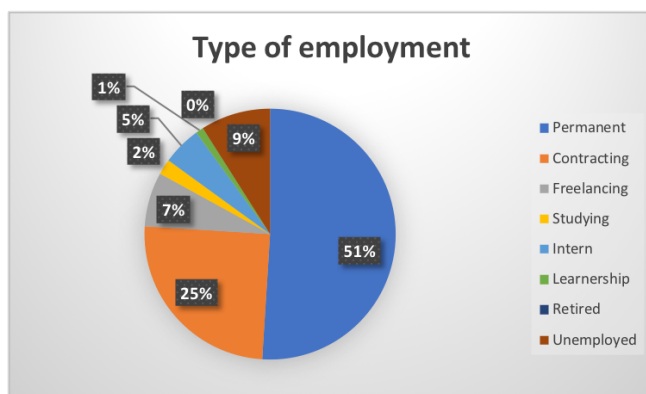


Years of service

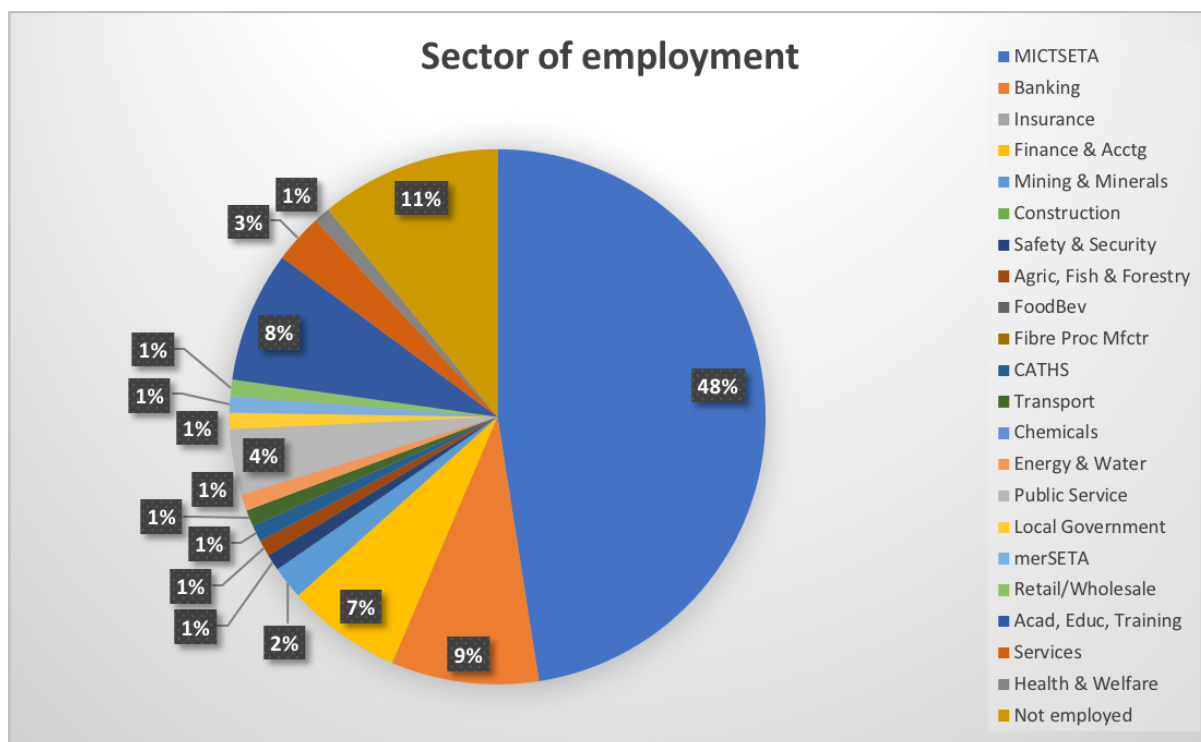


There is no change to the fact that most respondents work in a small (1-9) department or a large one (100+). 44% (46%; 56%; 56%; 57%) have performed their current role for between 1 and 5 years, 42% (36%; 48%; 48%; 50%) have worked for their current employer for between 1 and 5 years and 18% (5%; 3%; 3%; 3%) have been in the industry for less than a year, reverting from the trend shown during 2010-2016 to that of our

earliest Survey. In 2008, this figure was as high as 22%, supporting the trends identified from the Corporate respondents of the drastic decline in hiring in the period 2012-2017. 37% (64%; 55%; 55%; 57%) of responding practitioners have been in the industry for more than 10 years – a significant decrease on previous levels. This may mark a trend towards replacing retirees or emigrants with new entrants.

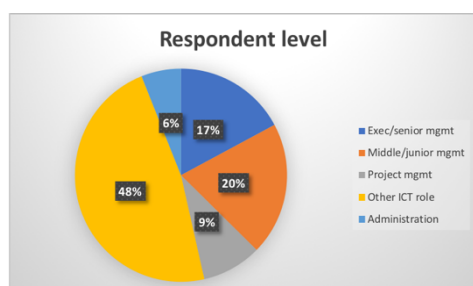


51% (69%; 77%; 78%; 79%) of practitioner respondents are in permanent employment. This proportion was almost unchanged from 2009 until 2016 but was noticeably lower in 2017 and even more so in 2018. The flexibility of skills resourcing offered by the existence of the contractor pool now up to 25% (15% in 2017, down from 17% of respondents in 2016) is a long-standing vital component of the ICT industry's ability to apply labour where and when it is needed.



48% (42%; 55%; 54%; 55%; 53%; 72%; 60%; 57%) of respondents work in the ICT sector. We attribute the 2010 anomaly to the CITI responses mentioned above. Last year's dip is attributed to a greater number of insurance sector practitioners and academics responding in 2017. With more than half of practitioners working in other sectors, this underlines the pressing need for the coordination of data from ALL stakeholders in a formal, credible methodology. We continue to suggest that the SETAs set up a trans-sector mechanism that acknowledges the pervasive nature of ICTs and the skills required to support the various technologies.

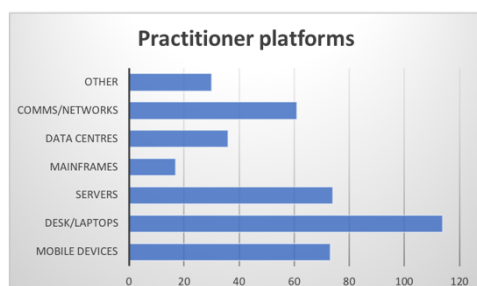
We continue to hope that there can be urgent progress with standardising the nomenclature of job roles and functions across sectors to make the planning of skills interventions more meaningful. Reliance on the inaccurate and misleading OFO codes can lead to poor policy and decision-making.



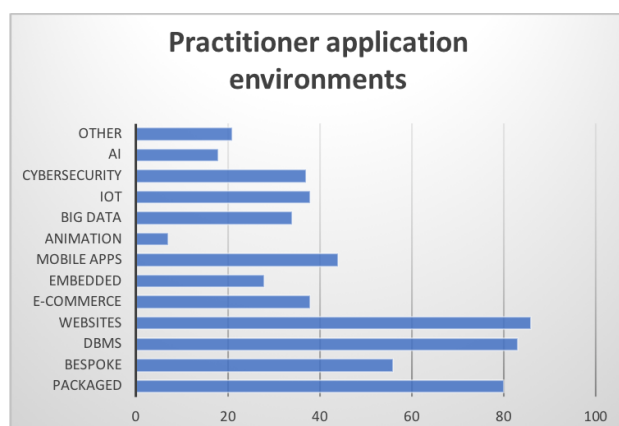
PRACTITIONER PRACTICES

17% (31%; 12%; 11%; 10%; 10%; 9%; 5%) of this year's respondents are working as executive managers, 20% (26%; 27%; 29%; 22%; 30%; 18%; 10%) are managing Operations or Development, 28% (20%; 15%; 14%; 14%; 15%; 29%; 15%) are in Programming or Development roles and another 20% (18%; 21%; 20%; 22%; 21%; 17%; 15%) are in Support functions.

There are some inconsistencies between how respondents view their level in the enterprise and the job title that they hold. This issue further emphasises the need for rationalisation of the job titles and job roles used in industry and the Organising Framework for Occupations (OFO) codes used by the SETAs and DHET.



As with the previous 5 surveys, in 2018, most respondents are “platform” aligned, with PCs predominating, followed by Servers and Mobile devices. We note the continued involvement with Data Centres, indicating a growing use of these facilities. A very high proportion of respondents work across multiple platforms.

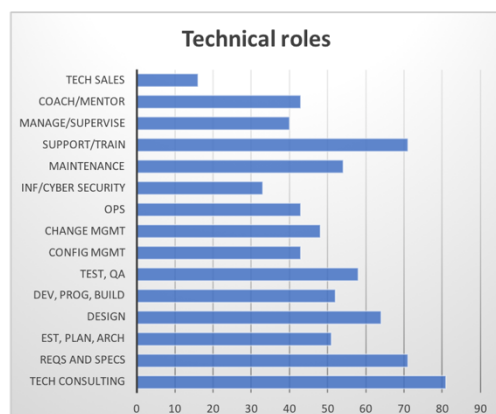


In software development and implementation, website development has occupied the highest number of practitioners in 2018, nudging our database management systems which engaged the largest number of practitioners for the previous three years. Those working on implementing packaged software make up the top three. We introduced the animation and mobile/gaming categories in 2012, but there has been little growth in the number of practitioners reporting in animation, in contrast to the rise in mobile/gaming. Internet of Things and Big Data/Analytics were

introduced in 2016, as emerging application environments and we already see significant increase in participants in 2017 and 2018. Cyber security was last year’s new entrant and involves a growing group of practitioners. This year’s new entrant is Artificial Intelligence.

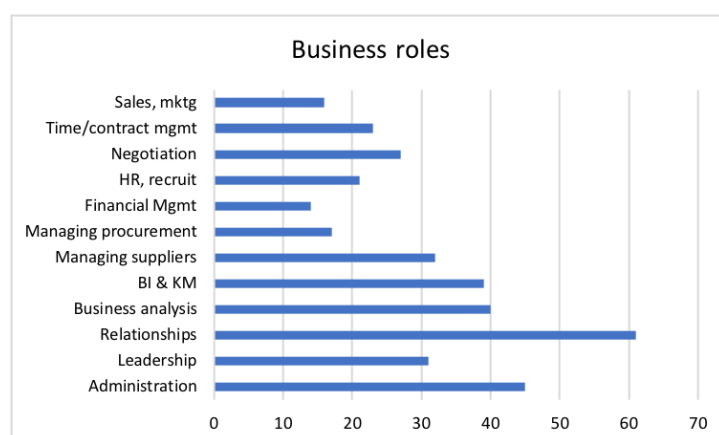
The emphasis on servers and DBMS, combined with the growth in IoT and Big Data, shows the continuing importance of business intelligence and knowledge management systems to support decision-making. Engagement in mobile systems and other communications infrastructure reflects the continuing trend towards mobile users. On average, practitioners work across more than three application environments.

MULTI-TASKING



We see little change in the range and mix of business activities engaging the practitioners. The average South African ICT practitioner continues to perform multiple task sets, with only a few identifying their role as “specialist” in nature. An average of 4,9 (4,1; 4,8; 4,7; 5,0) task areas are engaging technical practitioners and 2,3 (2,3; 2,9; 2,9; 3,7) for the business-focused people. Only a minority of respondents describe what they do as involving less than three areas of activity. As we have commented before, we understand that it is appropriate for complementary roles to be performed over time, such as design, developing requirements, programming, testing and

maintenance. In small enterprises, skilled practitioners will be responsible for all phases of management, administration and systems development.



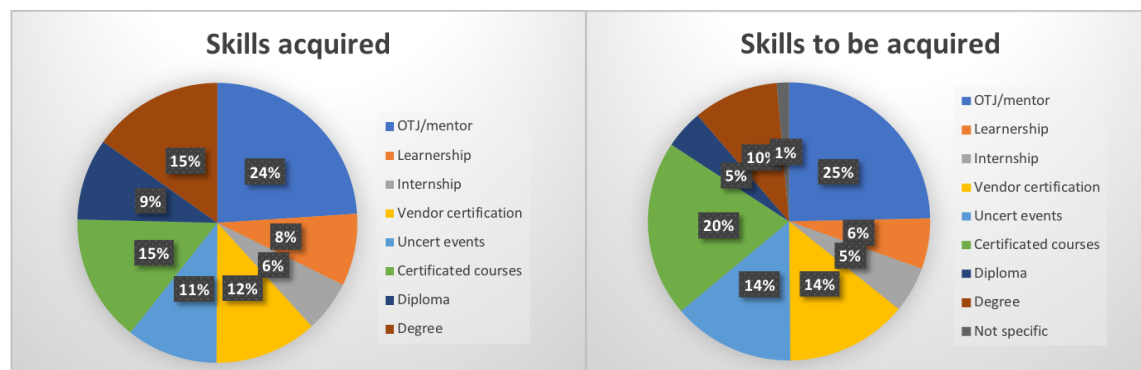
We have raised the flag of the multi-tasking issue in every report. If a practitioner perceives that they are performing several different roles, from technical consulting to administration, from programming to client management, from business analysis to outsourcing arrangements, it is difficult to see how they can maintain focus on specific objectives while juggling these responsibilities. It is unlikely that they have the required strengths in all these activities or the time

available to carry them all out, which would lead to a degree of underperformance in some areas. It also leads to over-dependence on the individual concerned, who may be perceived as “irreplaceable”.

However, while there is an economic case for greater division of labour, the multi-tasking phenomenon is entrenched as a fact of ICT practitioner life in South Africa and shows little sign of changing.

SKILLS ACQUISITION

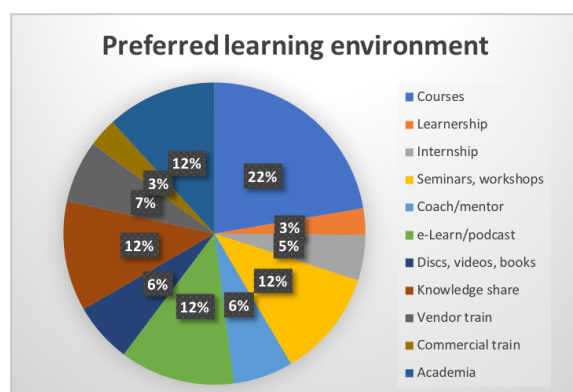
As in all the previous surveys, respondents showed how they had acquired their skills in the past, to qualify them for their current post, and how they intended to acquire skills in the future, to maintain their value in the job market.



In 2014, we changed the presentation of this response to indicate the primary contributor to past skills development of the practitioner. The predominance of “on the job experience or mentoring” is fairly constant, reported by 24% (27%; 27%; 29%) of respondents in this survey. Outside of the work environment, the need for “proof of learning” in the form of a certificate, diploma or degree for just more than half of our respondents.

Looking ahead, there is very little change from the last four years. Skills acquisition through experience, supported by short courses that lead to certification (whether vendor-specific or not) are preferred by practitioners. Pressure of work makes less time available for continuing academic studies, even on a part-time

basis. In spite of the preference for on-site learning, almost as many respondents indicate that the transfer of knowledge is best suited to an environment outside of the actual workplace.



In 2017, we observed a shift away from on-site learning to offsite, when 53% of respondents preferred the latter. In 2018, the pendulum swings, and we show 57% of respondents favouring on-site again. There is still a high level of interest in courses and seminars/workshops. The shift away from commercial and vendor training remains, with ongoing support for e-Learning/Podcasts and knowledge sharing. As previously, there is still a strong interest in academic offerings.

A separate survey among IITPSA members (still to be published) showed that almost half of the respondents receive support for career development from their employer, mainly in the form of study leave. The study also showed that almost one-third of respondents preferred to develop skills “on the job”, with a quarter looking at academic institutions.

CONCLUDING REMARKS

Since the first JCSE ICT Skills Survey Report in 2008, we have repeatedly expressed mixed emotions about the state of play in the South African ICT sector. We are a country that produces ICT research and innovation that is not only world-class but often world-beating, yet we struggle to make ICTs affordable and available to the majority of our population.

The continuing priorities that this research reveals are: the need for investment in teaching and training; the potential contribution to society that filling the ICT skills gap will make; the benefits that can come from better coordination and planning; the urgent need to move plans from discussion to execution.

The past twelve months have seen considerable political upheaval and a stagnant economy, with a weakened currency and little prospect of short term improvement. The ICT sector is traditionally more buoyant than others but is struggling to make headway against the prevailing conditions.

There continue to be successful initiatives and interventions in the skills development pipeline. Pupils and teachers are benefitting from technology in the classroom, such as training programmes from companies like Google and SAP. Young people can engage with activities in technology hubs, such as the Tshimologong Digital Innovation Precinct in Braamfontein, where they can acquire not only technical skills but also get exposure to entrepreneur development and business incubation.

With a globalised information technology market approaching US\$4 trillion in 2018, the demand for relevant skills will continue to outstrip supply. South Africa’s opportunity is to empower its Black youth to fill the gap, to boost the economy and to extend these benefits into the broader continent.

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