Public Service Sector Education and Training Authority (PSETA)

RESEARCH REPORT

EMERGING TECHNOLOGIES IN THE PUBLIC SERVICE SECTOR

AND

THEIR SKILLS IMPLICATIONS

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EMERGING TECHNOLOGIES IN THE PUBLIC SERVICE SECTOR AND THEIR SKILLS IMPLICATIONS

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Executive Summary

The world is experiencing a major shift in service delivery methods - from traditional to digital. This shift has arguably prompted governments to follow suit and adopt emerging technologies to deliver services to the public. For the purposes of this research, emerging technologies (ET) in the Public Service sector represents the new and innovative technologies adopted by the sector – these technologies generate changes in procedures which improve efficiency, transparency, communication, and interaction with citizens, thus improving service delivery (Valle-Cruz, 2018).

The terms “ET”, “Fourth Industrial Revolution” (4IR), “digitalisation”, and “e-Government” are rapidly becoming the most talked about themes in the Public Service sector. The extent to which these ET are implemented in the Public Service sector in the daily activities of government remain under-researched. The project purpose is to ascertain which transversal skills will be needed in meeting future demand and supply of skills within the Sector.

The project seeks to presents these findings and recommendations of the research study produced from primary (surveys and consultations) and secondary (desk-top based research and literature review) sources of information in order to triangulate data around these findings, providing recommendations and insights into these factors.

The main objectives of the research centred around gathering evidence on the prevalence and examples of ET as implemented by various departments of the Public Service sector. This report uses “ET” and “4IR” interchangeably.

International Best Practice

The study established a baseline understanding of emerging technologies in the public service sector through literature review. This encompassed a study of international best practice through case study analysis. The case studies chosen represent three developing countries (Brazil, India and Indonesia) that South Africa could emulate.

Much like South Africa, Brazil, India and Indonesia face similar challenges with their human capital and lag in capabilities related to digital skills, engineering, critical thinking and other key areas which are pivotal for future growth. The case studies highlight the following factors:

- All initiatives to technological change were facilitated by first addressing precursors to reforms;
- Each case study involved intentional and specific efforts to adopt technology to improve service efficiency;
- Each study required the leadership to have a balance between knowledge of the government ecosystem and faith in technological adaptation and innovation;
- All case studies required a shift in the traditional tendency to see a distinction between Government and the Private Sector, as the Public Service sector provided the skills to navigate the government complexities and the Private Sector brought invaluable knowledge around processes, technology and safeguards;
- All reform initiatives followed a holistic approach that develops people, business and technology simultaneously; and
- Every case study included focused efforts on obtaining staff buy-in. Hard (technology) and soft skill (culture, building trust and motivation) training was a key component in ensuring staff embraced and were committed to on-going training and development.

Impact on Government

Schoonraad & Mthethwa note that "the Public Service sector has always lagged behind in adopting new technologies and approaches" (2018). This statement is given credence by the current focus and understanding of "ET" and "4IR". Much of the response to the National Development Plan's (NDP) identification of ICT as a "critical enabler of economic activity" in South Africa has focussed on transitioning from manual, paper-based processes to the computer and internet (Simons, 2018). However, the full realisation of ET in the public service should encompass a number of developments such as smart cities, e-services and digitisation. The table below highlights examples of how ET may be incorporated in the context of government.

Table 0-1: ET Developments

ET Developments	Definition
Smart Cities	Where cities are strategically planned, integrated and digitised, and basic services are made easily accessible by technology.
e-Services	Where government services are taken online. The Gauteng Provincial Government is the first and only Provincial Government to have a Department of e-Government. By collating different Provincial Government Departments and their offerings on a single website, the Department has created a single point of access for citizens and employees to all Gauteng Provincial Departments. In addition, e-Services include the introduction of an Employee Self-Service (ESS) portal to "reduce the costs and time of running governments back office services" (Ngobeni, 2018).
Digitisation of Paper Processes	Where paper recordings are digitised. The Department of Home Affairs embarked on an extensive process of scanning and collating 5.8-million paper-based records per annum. This is expected to improve security and turnaround time when retrieving records, enable e-Governance and allow for forward, accurate planning for education and other basic social services (Odendaal, 2016).
Digitisation of the Classroom	Where schools utilise technology in teaching and learning. This may be in the form of e-learning, virtual lessons and "smart boards" and tablets in schools, harnessing ICT to improve education (Ngobeni, 2018).

It should be noted that much of the response around adopting ET has focused on ensuring the basics are in place, such as fast and reliable internet as well as digitisation, and the resultant processes they enable (smart cities and e-Services).

The potential of e-Government is being realised globally when it is placed in the context of overall government performance and governance (for example in Abu Dhabi, Korea and Australia), rather than of a series of technology projects (Infodev, 2009). e-Government has two significant roles that sit on a continuum:

i). A transactional role in increasing efficiency in delivering public services and how a government interacts with its citizens. This could be through submitting online applications, or renewing permits and drivers' licenses (Roblek et al, 2019);

ii). e-Democracy, which considers how using ICT via an e-government channel can increase public participation (e-participation) in formulating and supporting policies. This channel creates a direct link between participation in decision-making and formulation of public policies (Roblek et al, 2019).

e-Government should not be conflated with e-Democracy or e-Governance, as the latter consider how citizens interact with the political decision-making and implementation process, while the former is the provision of public e-services that may include an e-Democracy model.

There are various contact points and approaches to e-government model that interact with various end stakeholders such as:

Table 0-2: e-Government Models

e-Government Models	Definition and Example
Government-to-Government (G2G)	Refers to the relationships and channels between the different government bodies aimed at improving communication between them, achieving more efficient delivery, and avoiding redundancies and duplication between them. This builds-up cooperation and collaboration between government agencies. *Example: South African National Treasury IFMS (Integrated Financial Management System) which is a transversal integrated financial management system to be used by all National and Provincial Departments for Finance, HR, Supply chain and Business intelligence.*
Government-to-employees (G2E)	Aimed at improving interaction between the different government bodies and their employees, with the intention of generating higher productivity when managing human resources. *Example: e-training or e-payroll.*
Government-to-business (G2B)	Activity and relationship channels by the Government with business. G2B initiatives have been playing the important role in building a comprehensive and responsive e-Government environment in a “one-stop, non-stop and customer-centric” way, thereby enabling the promotion of business-to-business (B2B) initiatives to facilitate business firms improving their efficiency, effectiveness and reliability, thus becoming more sustainable and globally competitive. *Example: e-Procurement, VAT, Company registration.*

e-Government Models	Definition and Example
Government-to-Citizen (G2C)	Looks at the relationships and channels between the Government and its citizens or customers, placing the emphasis on the ability of the government and the public to pass information between the parties in an efficient electronic manner. *Example: Income taxes, car registration, birth certificates or declaration to the police.*

The study reveals that South Africa has a sporadic use of e-Government throughout the various Provinces and Departments. This would place South Africa, more generally weighted across all Provinces and Departments, within the Interaction and Transaction phases, with some outliers such as the Gauteng Department of e-Government and Public Services Innovations Centre at the transformation phases.

Furthermore, it should be noted that the various National and Provincial Departments show disparities at the provincial level in their access and exposure to 4IR. This gap is widening as social and economic issues prioritise more important agendas, with some being left behind when it comes to ET implementation.

Interviewees mentioned that more incentives for change are required as currently only the DPSA sets the agenda, highlighting a need for a more interactive and proactive coordinating body to engage across the Public Services Sector.

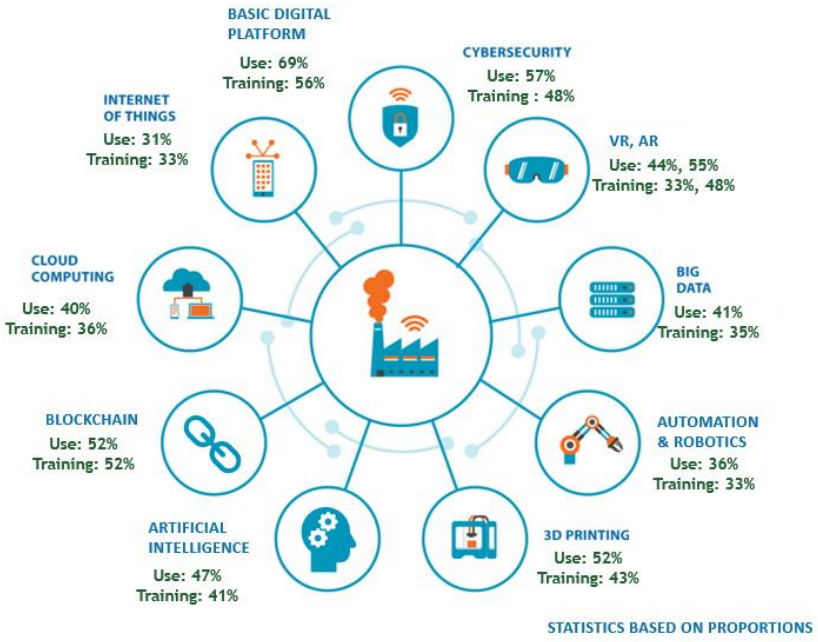
There is a growing trend towards G2E models relating to e-learning for employees. There was also a shift towards recognising the limitations of paper processes and the risks presented by COVID-19. In this way, there was a consensus that ET can impact government services positively through better resource utilisation, time-saving, cost efficiencies, auditability, transparency and cross platform malleability.

Some Departments, such as DHET and DIRCO, given their nature, will require a gap analysis and process realignment to reconcile digitisation with their bureaucratic and legal systems.

Prevalence and Impact of Emerging Technologies in the Public Service Sector

The figure below demonstrates the use of ET in the public sector and the extent to which employees are trained in these technologies.

Survey Finding 0-1: ET Use vs Training in Public Services Sector



Source: PSETA Emerging Technology Survey, 2020

The above diagram shows the discrepancy between skills demand (use) and supply (training), highlighting skills gaps that need filling through upskilling and reskilling.

The most prevalent ET used is a basic digital platform (used by 69% of respondents), such as the Central Supplier Database (CSD), followed by cybersecurity (57%) and Augmented Reality (55%). In all three instances employees are not adequately trained in these.

From the consultations, it was evident that many Public Service sector employees are not trained on ET. Interviews indicated that training focused on Cloud Computing and Cybersecurity. There are still gaps in training related to Basic Digital Platforms, Cybersecurity, Big Data, 5G and Cloud Computing specifically.

The majority of respondents view emerging technologies impacting positively on service delivery, efficiency, communication and transparency. Slightly more respondents (57%) had positive views on its impact on employment in the sector.

From the consultations, it was evident that stakeholders were more open to the use of technology in light of COVID-19. Many see that technology may increase productivity and that skills development is a key factor in this regard. ET looks set to improve service delivery, productivity and institutional communication and respondents feel positive about it improving the public services' ability to do its work. There were,

however, concerns regarding the urban-rural divide, in that ET may benefit urban communities more than rural ones.

Impact of Emerging Technologies on Skills

Much of the government's effort to adopt ET has focussed on transitioning from old paper-based and manual processes to the digitised solutions of an e-Government.

However, South Africa's historical skills shortage and lack of ICT skills limits the adoption of ET. South Africa has one of the youngest populations in the world and more than 60% of Sub-Saharan Africa's population is under the age of 25 (Mail & Gaurdian, 2020). This emphasises the need for adequate investment in education at all levels to equip the new generation of Africans joining the workforce with the right skills. This is especially valid given South Africa's digital skills gap, more so since the Public Services Sector is the largest South African employer.

The MICTSETA SSP (2019) points to a lack of experienced candidates as the main reason for skills shortages in ICT. It notes the emergence of cloud computing, big data and organisations moving into open source platforms. The MICTSETA SSP indicates a need for IT professionals to remain knowledgeable and that new technologies render some practitioners obsolete. Although there might be some supply of general skills, there is often a need for practitioners to have experience and background in mobile applications, for instance, as this is an emerging area (MICTSETA, 2019).

This speaks to developing future skills through basic digital literacy and training, and continuously developing current digital skills in line with technological changes. Digital skills are essential in creating access to a wide range of opportunities and ensuring workers have the skills they need to be more employable, productive and creative. The development of these skills, along with inclusive growth, are essential in attaining new economic drivers while bridging the digital divide or technology access inequality. To attain up-to-date and market relevant training and development, it is recommended that PSETA reinforce partnerships with MICT SETA and other SETA.

Further partnerships recommended speak to continuous learning environments facilitated internally while remaining relevant to industry in course curricula and providing the Public Service sector with transversal skills that can be used within and across government departments. The focus should be on developing "skills for life". This is a feat that requires stronger and more ubiquitous private sector partners in

unlocking change and innovation through e-learning content as well as understanding industry requirements. Recognising and formalising prior learning and short courses (e.g. Microsoft Azure) can reduce skills shortages and help the public service keep up with international technological developments. The SETA should facilitate discussions with the QCTO on how short courses can be recognised and funded more within the SETA framework. However, this process should not be cumbersome and drawn out- an advantage of short courses is that they are agile and responsive, and this should not be undone.

Respondents see the following employee levels requiring skills and knowledge in the following ET:

Survey Finding 0-2: Occupational Group and Skills Needed

Employee Level	Top 3 ET to Know
Lower-Level Employees	• Basic Digital Platform (64.29%) • Cybersecurity (64.29 %) • Automation and Robotics (57.14%)
Mid-Level Employees	• Cloud Computing (85.71%) • Basic Digital Platform (78.57%) • IOT/ Automation and Robotics (78.57%)
Senior-Level Employees	• Virtual Reality (VR) (100.00%) • Big Data (92.86%) • Augmented Reality (AR) (85.71%)

Source: PSETA Emerging Technology Survey, 2020

The study reveals that most public employees in lower levels require knowledge and understanding of basic digital platforms, Cybersecurity and Automation and Robotics. Mid-level employees require understanding of ET that impacts day-to-day operations, i.e. Cloud Computing and IOT. Senior level employees require training in the use of Big Data analysis for strategic decision making and VR and AR.

It was also mentioned that mandatory Cybersecurity and basic digital literacy be a government-wide training module to avoid data breaches and Cybersecurity vulnerabilities. The ability for decision making will be improved due to real-time data and access to ET tools in understanding that data.

The table below shows where emerging technologies may have the biggest impact in government functions.

Survey Finding 0-3: Top 3 key ET per functional area

Functional Area	Top 3 Impactful ET
Administration functions:	• Basic Digital Platform • Cloud Computing • Cybersecurity
Management functions	• Cloud Computing • IOT • 5G
Planning functions:	• Cloud Computing • IOT • Blockchain

Functional Area	Top 3 Impactful ET
Policy Making functions	• Basic Digital Platform • Cybersecurity • Cloud Computing
Frontline Service Delivery:	• Cloud Computing • Basic Digital Platform • IOT

Source: PSETA Emerging Technology Survey, 2020

ET would mostly be applied to aid in administration processes, planning and management functions. Discussions pointed to more use of Cloud Computing, Basic Digital Platforms, Big Data and Cybersecurity being mentioned often in the application of administrative and management functions.

From the surveys, it was evident that majority of public employees in lower levels require Computer Literacy, Customer Service and Numeracy Skills. Mid-level employees require Communication and Interpersonal skills, Records Management and Technical skills in day-to-day operations. Senior level employees would require skills around Financial Management, Leadership and Strategic Management. During the consultations, basic digital skills were often highlighted as a need for lower level employees, while more emphasis on change management and leadership was placed on senior and mid-level employee ranges.

Respondents mentioned that there need to be more awareness sessions, online training and mentoring to enable the public service sector to better handle change. Furthermore, training needs to happen regularly through re-skilling and re-training- more funding needs to be channelled towards relevant training and capacitation of employees.

The majority of respondents highlighted change management as a key requirement in adopting ET. Some examples of change management include open discussion and transparency through workshops, courses or conferences. Providing change management sessions will reduce the fear of the unknown associated with change, as well as the mistrust in technology that some employees have.

Impact on Enablement Environment

The foundations of successfully harnessing ET comprise of a sound infrastructure, coordination mechanisms and robust collaborations through partnerships to enable the use of ET.

Limited investment in digital working tools, such as an internet connection and computer, was revealed by the COVID-19 pandemic to be a weakness. Various Departments struggled to suddenly attain digital tools of trade, which with hindsight would have led to a more robust remote working strategy had it been the normal way of working before the pandemic. Digital tools of trade are part of the enablers of 4IR and ET. These not only aid in delivering training but also create virtual offices through remote working - creating productive outcomes. Without laptops and data, digital strategies are difficult to enact. Furthermore, access to broadband and low bandwidth capacity have presented as major issues. SITA, as the administrator of government networks, creates barriers through content restriction and restrictions on access to third-party or non-approved programs. The National School of Government, for example, has had to resort to new strategies in delivering content in a low-bandwidth environment through non-enriched content and simple media. This impacts on the quality and enrichment of the curricula.

The basic underlying infrastructure, such as electricity supply, data and WIFI, along with the required tools, such as laptops, are key enablers of any digital “revolution”.

Laptops and LTE and/ or 5G connections need to be deployed across all levels and not solely at the middle to senior management level.

Employee perceptions, cultural and demographic factors, as well as institutional culture play an important role in change management and effective communication. A lack of change management and communication are sighted as some of the key barriers to implementing innovation and ET in government.

When asked of the risks of working remotely, it was noted that respondents believed cybersecurity to be the main risk. Other respondents cited the current paper processing norms in government, including having to print and sign hardcopy documents.

To digitise paper processes, a department wide national e-signature process needs to be developed. To consider a paperless process, the National School of Government and the Department of International Relations require a way to ensure e-signatures

are secure. The reliance on physical signatures also limit integration with digital solutions. Compliance and audit processes tend to be a barrier. Departments inadvertently create barriers when handling paper as it will be that same paper that will be sought by auditors looking for a paper trail. However, a “paper-trail” can be maintained online.

Furthermore, data records, and content management through system and communication interoperability are essential in enabling a successful e-Government. This emphasises a need for alignment between National, Provincial, and Local government.

The COVID-19 Effect

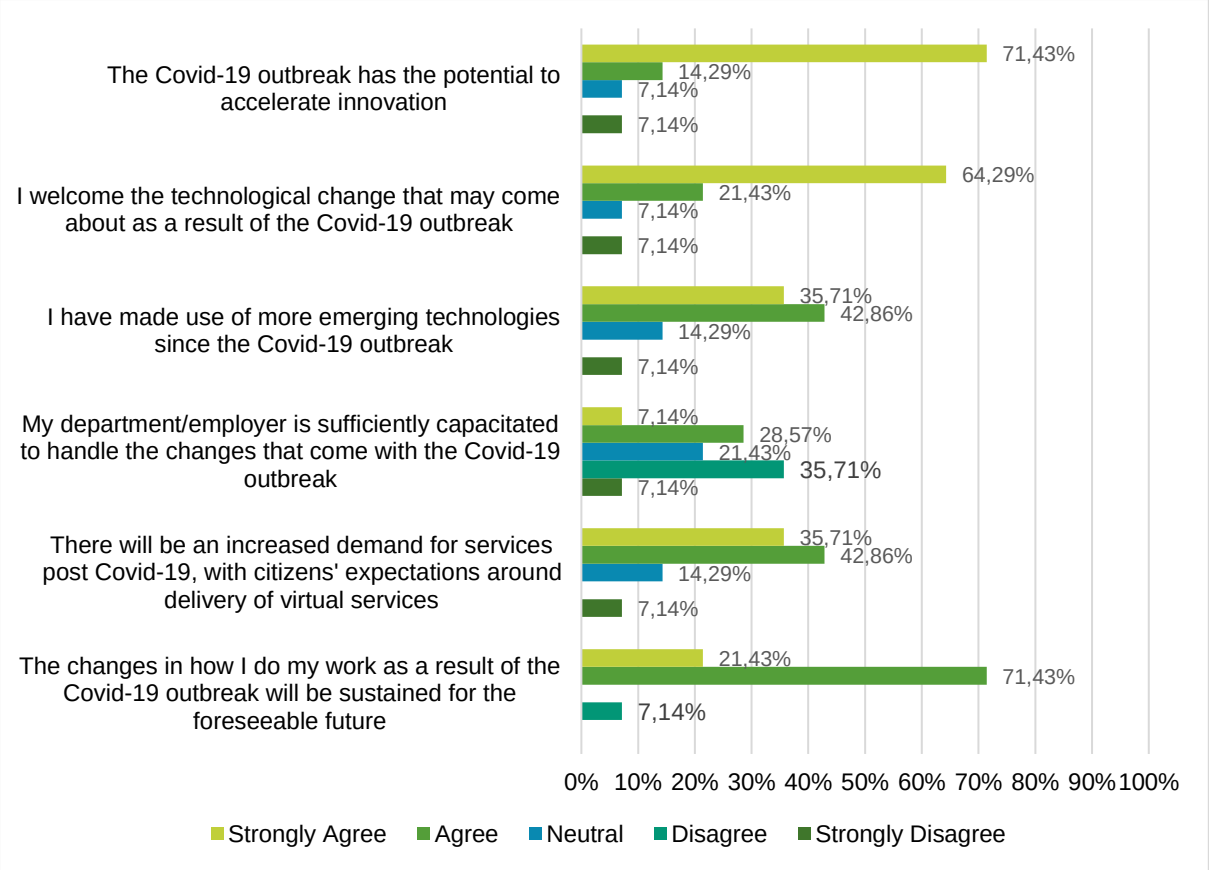
COVID-19 swept across the globe with devastating effect, many lost their lives and others lost their livelihoods due to the lack of economic activity. The pandemic had brought many sectors to a standstill. The Public Service sector is not immune to the impacts that such a drastic closure of the economy has created.

But COVID-19 has also accelerated and pushed the agenda for the use of digital technologies in all sectors, including the Public Service. COVID-19 has also exposed weaknesses in business continuity models, with wide-ranging disparities across Provinces, especially for those that had previous socio-economic issues, further hindering the use of ET.

The pandemic has demonstrated to the Public Service sector that it needs new ways to adapt. Upskilling and reskilling, especially in basic digital skills, have become more important than ever.

The following graph presents the impact of COVID-19 on the sector as it relates to ET.

Survey Finding 0-4: Impact of COVID-19 and ET



Source: PSETA Emerging Technology Survey, 2020

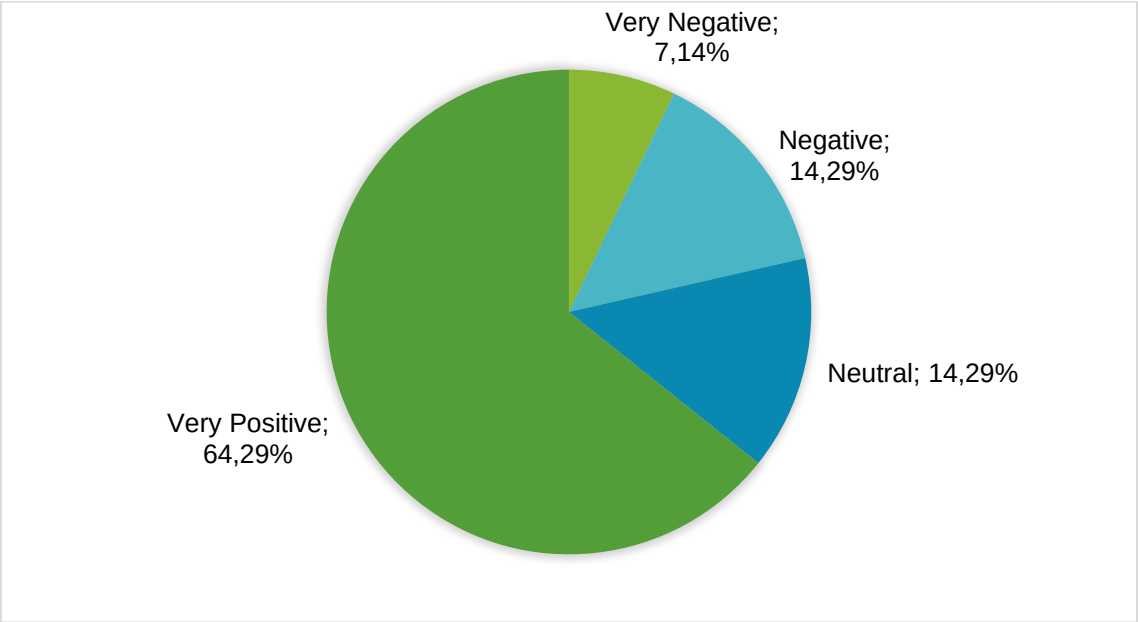
Respondents strongly agree that COVID-19 has accelerated the use of innovation, with technological change being more accepted than before COVID-19. Furthermore, 43% agree that they have made more use of ET since COVID-19, while 43% believe they their employers were not sufficiently capacitated to handle the changes brought by COVID-19. Most respondents agree that, due to COVID-19, increases in services demanded by citizens will be delivered virtually and that changes posed by COVID-19 will be sustained in the foreseeable future.

The interviews reinforced the above survey data, with interviewees seeing a larger role of ET being implemented in their Departments. The overall sentiment towards the use of technology is positive and recognised as having a sustained role to play today and in the future, due to COVID-19 driving the adoption of technology usage. However, many National and Provincial Departments are under-resourced in providing the digital tools and training required, to move into virtual or remote settings.

When asked what technologies they have been exposed to during lockdown, respondents mentioned the use of videoconferencing solutions such as Microsoft Teams and Zoom and the use of Cloud based software such as Microsoft 365 and Azure. Furthermore, there was a growing trend and interest around online e-Learning platforms in delivering training remotely.

Majority of respondents believe that the COVID-19 outbreak will have a positive impact on the way work is done. This is presented in the chart below.

Survey Finding 0-5: Impact of COVID-19 and Ways of Work



Source: PSETA Emerging Technology Survey, 2020

Key Findings and Recommendations

The table below outlines key focus areas related to findings and the recommendations to resolve areas of development when it comes to ET and its implications for skills development and use within the Public Service sector.

Table 0-3: Key Findings and Recommendations

	Focus Area	Recommendations
1	**Partnerships**	• Continue current practice. We acknowledge that the PSETA currently arranges stakeholder forums where sector specific updates are provided, and knowledge is shared amongst stakeholders. • Act as a catalyst. The SETA cannot effect change within the Public Services Sector by itself, but it can connect stakeholders, learn from each other and share experiences as to how they are managing the impact of the 4IR. • Partner with other SETAs. It is important to partner with other SETAs (MICTSETA for example) and formulate a coherent approach in dealing with 4IR related skills as there may be a significant overlap in challenges and opportunities being faced across sectors. This unified approach is likely to be driven by DHET. • Consider creating global partnerships. This can facilitate fast learning taking learning curves from international best practices. Example: partnering with Microsoft, SAP or Google in acquiring new skill sets. We further note that the above would further the principle encapsulated in the NSDP, being “Increasing collaboration between the skills system, government and industry” • Collaborate and engage with the NSG to see how content can be leveraged and delivered. Furthermore, this also speaks to the Public Services Sector Curriculum. So that in-demand, timely and relevant courses through insights in the WSP and ATRs can lead to faster curricula adaption. • Engage with the QCTO. Short-courses are not formally NQF recognised. The SETA needs to see how more recognition for prior learning can be achieved. This is especially true for continuous technology changes and when it comes to technical skill sets e.g. Microsoft Azure training

	Focus Area	Recommendations
2	**Training at School Level**	• Share findings with Department of Basic Education. The SETA should share its findings to assist with the structuring of school curricula to account for job market requirements, insofar as this relates to 4IR requirements. Align curricula towards what the market may require in the next 3 to 5 to 10 years. • Build basic digital skills. The SETA should fill this skills gap required as the foundation for all ET. • Develop innovation and entrepreneurial based-curricula is key to ingraining change and adaptability at a young age as a key trait.
3	**Change Management**	• Equip and train employees in change management skills. In addition to equipping employees with technical skills required to manage 4IR technologies, focus is also given to training employees on change management techniques • Increase conferences and workshops mentioned above in focus area 1, in addition change management should also be explored. • Create a mandatory focus on basic foundations of cybersecurity and technology best practices training. This should be a ubiquitous and mandatory module to aid in employee insecurity and mistrust of technology. • Increase incentives and KPIs focused on technology adoption to bolster technology trust. New technology adopters should not be penalise or create adverse behaviours to technological experimentation.
4	**e-Learning enablers**	• Provide access to laptops and 3G/4G/LTE/5G data cards. A more ubiquitous access needs to extend across all Public Services Sector levels if required for remote or virtual working. This is also a pre-requisite for e-learning. • Procure better quality data lines. The detracting feature of low bandwidth is that is does not offer rich content, webinars or online

	Focus Area	Recommendations
		lecture capturing and streaming functionalities and is limiting the ubiquity of e-Learning platforms. • The SETA to consult the SITA. Discussion are to be had around the use of more suitable video streaming or changes to site restriction rules in order to make content more widely available 24/7. • Realign the evaluation and moderation process. This needs to be updated in being e-Learning friendly and virtual facilitations.
5	**Uncertainty surrounding the impact of COVID-19**	• Promote access to digital tools. This was overshadowed by the lack of resources and tools of the trade as well as training around digital tools dampening their remote working ambitions even though this is highly possible. • Training focused around use of Microsoft Teams and other virtual office software to socialise public users while boosting their confidence. • The SETA should consider undertaking virtual roadshows to schools to educate learners regarding new career paths within the Public Services Sector space and the importance of digital skills given COVID-19 and the future of skills.
6	**Change that is driven from the top**	• Upskill and reskill senior employees in 4IR related skills in order to leverage 4IR technologies and cascade these skills down to lower occupational groups. • Bridge the digital divide, by providing lower occupational levels with training and access to digital tools. • Develop leadership and change management in senior employees as the drivers of the change.
7	**Impact of negative external economic factors**	• Implement project prototypes in order to see if a viable solution can be scaled once tried and tested. This will also create momentum for 4IR and change. • Focus prototypes on the ET that increases service delivery, increases effectiveness and efficiency, lowers costs in the provision of government services. • Promote use-cases that increase efficiency and reduce costs, e.g. predictive analytics, in order to help protect employees in a difficult

	Focus Area	Recommendations
		economic climate as the institutions has funds it can mobile or reinvest into further training and development.
8	**Inadequacy of training programmes**	• Improve the time it takes to update or develop programmes. • Improve the consultative processes for updating or developing courses by accelerating the process to include interested parties. • Introduce and/or emphasise unit standards on soft skills. This is expected to improve learners' mobility and employability within the Public Services Sector. • Introduce and/or emphasise unit standards on cybersecurity. This is expected to boost learner's morale and technology confidence. • Whilst programmes are relooked at to include more emphasis on soft skills, short programmes can fill this void. • Focus on recognition for prior learning and acknowledging technical programs that are sought after in the market place i.e. Microsoft Azure Developer certifications.
9	**Infrastructure and Tools**	• Remodel how skills capacitation functions and is delivered. That is, how digital tools are provided and fit into the training. • Collaborate with SITA in understanding how to move from a 3IR to a 4IR in providing more effective infrastructure or pilot programs in order to complement the investments made in skills development programs.

1 Introduction

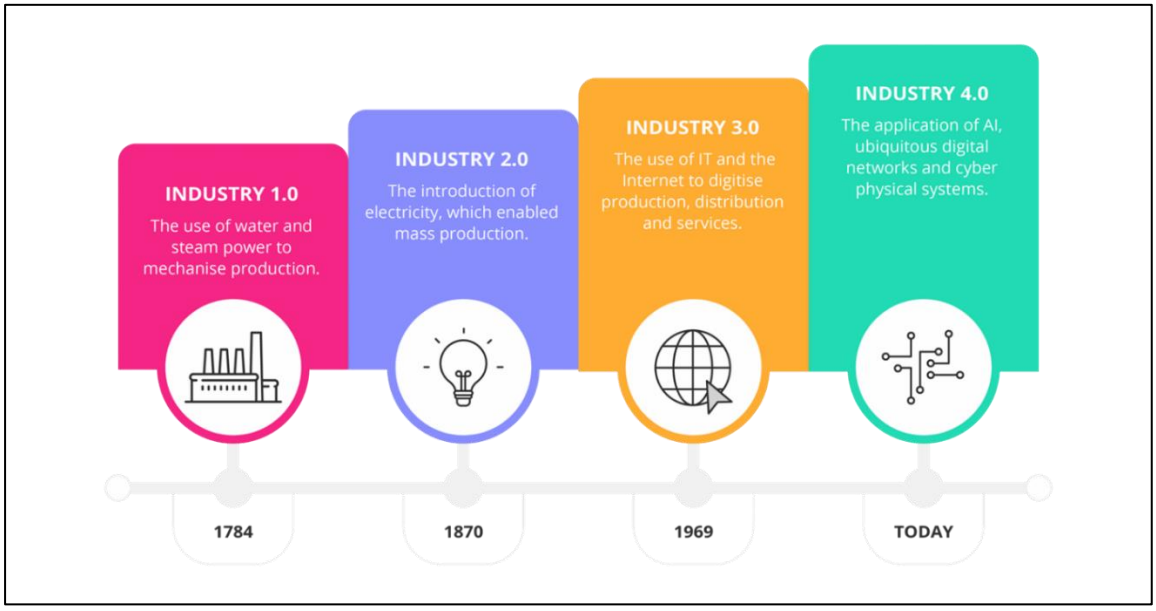
The term “Fourth Industrial Revolution” (“4IR” or “Industry 4.0”), coined and popularised by World Economic Forum (WEF) Founder Klaus Schwab, describes the next stage in technological advancement and human progression.

According to Schwab (2016):

> *“The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to automate production. Now a Fourth Industrial Revolution is building on the Third, the digital revolution that has been occurring since the middle of the last century. It is characterized by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres.”*

4IR builds on the three previous revolutions. As may be noted from the description of industrial revolutions by Schwab (2016), all industrial revolutions have been enabled by breakthroughs in technology which transformed the way industry operated and, by extension, society.

Figure 1-1: History of Industrial Revolutions



Source: (GetSmarter, 2019)

ET may be defined as “new technologies that are currently developing or will be developed over the next five to ten years, and which will substantially alter the business

and social environment" (Business Dictionary, n.d.). ET is interchangeable and synonymous with 4IR, as 4IR is a sub-set of emergent technologies.

4IR is characterised by the inter-relatedness of technologies and the connection between humans and technology, 4IR describes "disruptive technologies and trends [that] are changing the way we live, work and relate to one another" (AfroAnt, 2019).

The technologies ushered in by 4IR constitute ET. Noting the speed at which new technologies emerge in the 4IR, Schwab (2016) comments that "ET and broad-based innovation are diffusing much faster and more widely than in previous one [industrial revolutions]."

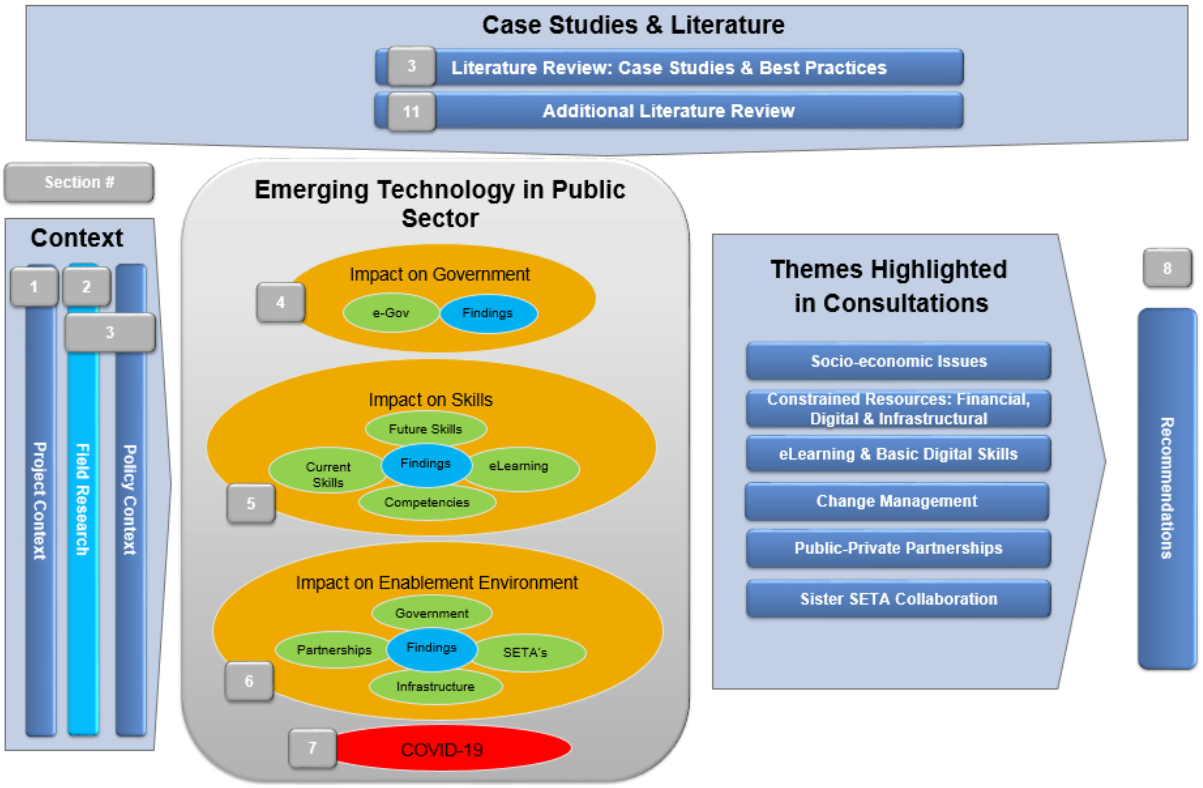
Technology and its application can usher in new service delivery models while reducing inequality if used ubiquitously and strategically. This is an exciting topic, creating much hype due to the infinite possibilities ET and 4IR offer.

Given this context, the report presents the findings and recommendations of the research study produced as part of the Research on Emerging Technologies ("ET") in The Public Services Sector and Their Skills Implications (the "Project" or "study") for the Public Services Sector Education and Training Authority ("PSETA" or the "SETA").

The document details the findings from primary and secondary research, as well as a review of key literature and case studies.

In order to guide the reader, the following contextual approach diagram shows the interlinkages of the various sections and the methodology on how recommendations have been derived.

Figure 2:Contextual Approach Diagram



The report begins by outlining the project background and context, the purpose of the study and the scope of work. The next section describes the research methodology adopted for the study. Primary research is analysed to offer the insights contained in this report. This analysis of data collected is both quantitative and qualitative. The qualitative data is sourced through comments made by National and Provincial Departments, Offices of the Premiers and training providers through surveys and interviews, whilst the quantitative analysis is based on survey results and available statistics. Elements of the research conducted will be found across sections **4**, **5**, and **6**.

Section **3** focuses on defining Emerging Technologies ("ET") and the Fourth Industrial Revolution (4IR), followed by exploring the current context in the drive towards digitisation in the South African Context. This section considers the Presidential 4IR Commission, the policy implications and identifying key stakeholders in the innovation landscape.

Thereafter, the Literature Review, which is based on selected case studies and supporting literature, identifies key themes that have been identified and reviewed,

which focus on defining best practices that other countries have adopted in order to prepare for 4IR. The additional literature can be found in the Appendix **11.**

The sections that follow explore how ET impacts Government (section **4**), Skills (section **5**) and the Enablement Environment (section **6**). The impact of COVID-19 and its relationship with ET (section **7**) will also be explored. In these sections the results from consultations and surveys are discussed.

The report concludes with a presentation of key findings and recommendations (section **8**) and the conclusion (section **9**).

1.1 Project Background

The world is experiencing a major shift from the traditional ways of delivering service to a more Information and Communication Technology (ICT) (Adejuwon, 2018) based way of delivering service. This has arguably prompted governments to follow suit and adopt technology to provide services to the public. For this research, ET in the Public Services Sector represent the new and innovative technologies, adopted by the sector, which generate changes in procedures and service delivery; in turn, these kinds of technologies improve different organisational features such as efficiency, transparency, communication, and interaction with citizens thus improving service delivery (Valle-Cruz, 2018).

The terms “fourth industrial revolution” (4IR), “digitalisation”, and “e-Government” are rapidly becoming the most talked-about themes in the Public Services Sector. As a result, there are different technologies that have been adopted by various departments in the public service, however, there is still a need for coherence and bringing together the evidence on the potential – and the limitations – of these ET in the sector.

One important effect of ET, if taken advantage of, will be the modification of daily activities of employees and departments, even so, there are still challenges associated with these technologies to surmount. Given that these kinds of technologies also perform activities that were previously exclusive to human beings (such as mechanical robots, service kiosks and ATMs), these technologies have the potential to replace people in their daily and routine activities. This will undoubtedly have implications for the competencies and skills required by the Public Services Sector departments to deliver upon their respective mandates.

The extent to which these ET are implemented in the Public Services Sector, and how they have modified and modernised the daily activities of government remain under-researched. Very little has been reported about the examples of ET in the Public Services Sector and how it is re-configuring government business models and skill sets. It is anticipated that the emergence of these technologies will lead to most occupations undergoing a fundamental transformation (WEF, 2016). While some jobs will be threatened by redundancy and others grow rapidly, existing jobs may also go through a change in the skill sets required to do them. With this research, PSETA hopes to improve the current stock of knowledge around what these shifts will mean, particularly for employment, skills and recruitment in the Public Services Sector.

1.2 Project Objectives

The project objective is to gather evidence on the prevalence and examples of ET as implemented by various departments of the Public Services Sector, and to:

- Outline the opportunities and threats presented by ET to the Public Service processes.
- Outline the implications in terms of transversal skills/occupations required and ones that will be obsolete as a result of ET.
- Outline the implications ET will have on employment and recruitment in the Public Service sector.
- Outline how the Public Service sector needs to react to the reskilling and upskilling of today's workers in order to respond to the modifications brought about ET.
- Outline mechanisms needed to ensure effective coordination and collaboration amongst all stakeholders (governments, educators, training providers, workers and employers in order to better manage the transformative impact of ET on employment, skills and education).

1.3 Project Rationale and Context

The Public Services Sector Education and Training Authority ("PSETA") has commissioned a study into the use of 4IR or ET within the Public Services Sector. This is to ascertain which transversal skills will be needed in meeting future demand and supply of skills within the Sector. The project seeks to presents these findings and

recommendations of the research study produced from primary (surveys and consultations) and secondary (desk-top based research and literature review) sources of information in order to triangulate context around these findings, providing recommendations and insights into these factors. This also provides an indication of the training opportunities and how to align organisational objectives, service delivery processes that could be further optimised and areas in which capital investments can be deployed to capitalise on these opportunities. The importance of understanding the demand and supply side around ET also is considered.

1.4 Scope of Work

The Terms of Reference articulate the scope of work as follows:

- Developing the following:
    - Project plan with the reflection on the understanding of the rationale and purpose of the project.
    - Research report outlining the prevalence and examples of ET as implemented by various departments of the Public Services Sector; this should highlight the opportunities and threats presented by ET to the sector. The implications in terms of skills/occupations required and those that will become obsolete as a result of ET will also need to be outlined by the research. All the areas highlighted in section **2.2** above will need to be covered by the research report.
    - Power-point presentation of the research report(s).
    - Close out report to PSETA.
- The project will cover the National and Provincial government departments looking at transversal skills only.

1.5 Research Overview

The Project included desk and field research to build an understanding of the sector and trends in which SETA operates in. The desk research involved collation and review of various journal articles, research reports, and government publications. To gain a practical understanding of the sector, field research was conducted, which included consultations and the distribution of surveys to National Departments, Offices of the

Premier, Provincial Departments and other Public Entities within the Public Services Sector.

1.5.1 Desk-Based Research

Various source documents were used in this report. The desk-based research included an analysis of multiple sources. SETA and skills planning documents analysed include:

- MICTSETA (2019): Sector Skills Plan 2020-2025
- PSETA (2018): Sector Skills Plan Update for 2019-2020
- PSETA (2017): Sector Skills Plan Update for 2018-2019

In addition to the above-mentioned sources, the desk-based research included an international body of literature and research from international case studies and best practices taken from Research and Academic Research Studies. Section **12** provides a detailed reference list of the literature consulted in the production of this report.

1.5.2 Field Research

Field Research was conducted through survey analysis and interviews. Surveys were targeted towards National Departments, Office of the Premiers and Provincial Departments provided by PSETA.

1.6 Document Structure

This document serves as the Emerging Technology Report for PSETA. The following table provides an outline of the sections contained in this document.

Table 1-1: Document Outline

Section	Description
1	Executive Summary
2	Introduction, Project Background of the Study and Document Overview
3	Research and Data Collection Methodology
4	Findings of the Literature Review with Regards to Case Studies and Best Practice What is the Fourth Industrial Revolution and ET. Provides a Situational Analysis of the Current Context Landscape
5	The Impact of ET on Government

6	The Impact of ET on Skills
7	The Impact of ET on The Enabling Environment
8	The COVID-19 Effect
9	Key Findings and Recommendations
10	Conclusion
11	References
12	Appendix: A Detailed Reference List of Additional Literature Consulted in the Production of this Report.

2 Research and Data Collection Methodology

Research for the project comprised of desk-based research and field research, covering both quantitative and qualitative methodologies. The desk-based research involved the collation and review of relevant documentation, as well as consulting publicly available data sources for additional information.

Field research included distributing electronic surveys and conducting interviews. Stakeholders consulted included National and Provincial Departments, The Provincial Offices of the Premier, amongst others.

2.1 Field Research Undertaken

The study based its findings on data gathered through surveys, interviews, the literature review, and case study analysis. This included **24** online survey responses and **14** interviews, totalling **38** consultations.

The table below provides an outline of the fieldwork undertaken, which includes the surveys and interviews.

Table 2-1: Consultations Conducted

Data Collection Method	Stakeholder	Actual Consultations
Surveys	National Departments	24
	Provincial Departments	
	Offices of the Premiers	
	Training Provider	
	Other	
Interviews	National Departments	14
	Provincial Departments	
	Offices of the Premiers	
	Training Provider	
	Other	
Total		**38**

Whilst National Departments were more responsive than Provincial Departments regarding the consultation interactions conducted, the surveys did not achieve the reach that was expected due to a large number of stakeholders not being contactable due to COVID-19 department shut-downs and working from home. This point will also

be explained in later sections as one of the underlying recommendations. Furthermore, **40** email addresses bounced back as the communication details provided were either outdated, the person contacted was unreachable or the survey link was blocked due to server permission restrictions.

These issues are articulated as research challenges in section Error! Reference source n ot found..

Overall, **38** consultations were conducted.

2.1.1 Surveys

It was decided to collect the bulk of the survey data through online surveys. Online surveys were chosen as they offer several advantages over face-to-face or telephonic surveys, namely: lower costs; convenience for respondents; design flexibility; and automation and real time access to results (Gingery, 2011).

Surveys were designed based on the need to obtain specific information needed by the study in order to assess the impact of ET. The primary goals of the survey were to gain insights into the extent of ET adoption in the sector, highlight key sector trends and demand in a changing landscape and understand the impact thereof on employment and growth.

Questions in the survey were predominantly based on a 5-point Likert scale (with 5 denoting the most positive response and 1 indicating the most negative response)[1]. The Likert Scale was adopted in order to quantify the adoption, trajectory and potential impacts of ET. A number of open-ended questions were also included within the survey in order to give further depth and understanding. This approach was taken in order to obtain an overall view of the adoption, trajectory and potential impacts of ET.

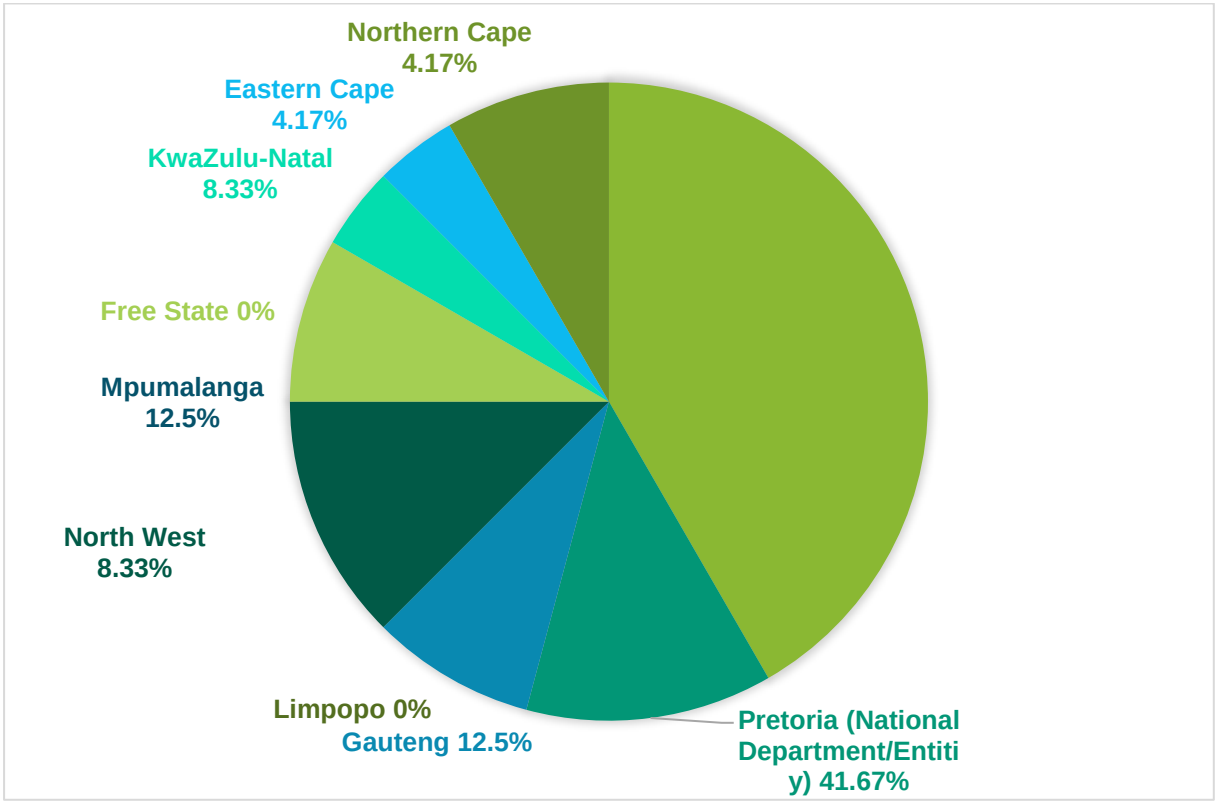
Overall, the surveys received **24** responses from National Departments, Provincial Departments, Offices of the Premiers and other stakeholders such as research organisations and consultants.

The electronic survey respondent breakdown was 41.67% being National Departments and 50.00% Provincial Departments or Offices of the Premier, with 8.33% of

[1] The Likert Scale is further explained in section **Error! Reference source not found.**.

respondents being a Public Entity or a subset of a National Government Department (e.g. SARS).

Survey Finding 2-1: Survey Participant Location



Source: PSETA, Emerging Technologies, Survey, 2020

2.1.2 Interviews

The purpose of the interviews was to generate qualitative data that would lend depth to the quantitative data generated by the surveys. Interview questions were derived from preliminary research and the Terms of Reference. A total of **38** interviews were proposed. The key stakeholder groups initially identified for interviews were National Departments, Provincial Departments and Offices of the Premiers.

Overall, **14** interviews were conducted.

The consultation interviewee breakdown was 50.00% being National Departments and 50.00% Provincial Departments or Offices of the Premier.

The Department of Public Service and Administration (DPSA), the Department of Communications and Digital Technologies (DCDT), 4IR Commission and State Information Technology Agency (SITA) were not contactable even after we had

escalated the urgency and importance of the interaction. While the Department of Science and Innovation (DSI), the Department of Labour and KZN Department of Co-operative Governance and Traditional Affairs were not available to partake in the study due office closures for decontamination purposes, and not feeling well due to COVID-19. The below stakeholders were contacted via consultations.

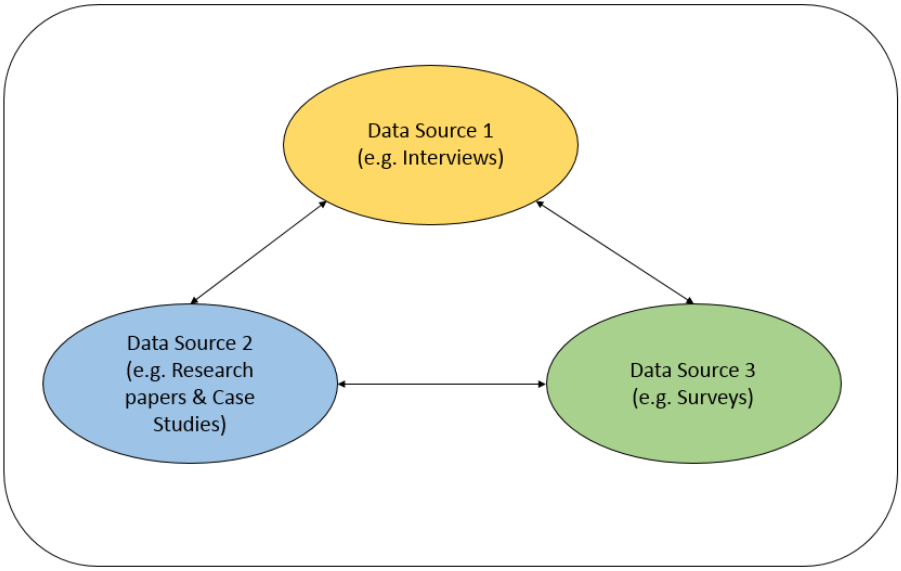
Table 2-2: Stakeholders Engaged

National /Provincial	Interviewee
National Department	Public Service Innovation Centre
National Department	National School of Government
National Department	Department of Public Enterprise
National Department	Department of Trade and Industry
National Department	Department of International Relations and Cooperation
National Department	Department of Higher Education and Training
National Department	National Treasury
Provincial Department	Western Cape Office of the Premier
Provincial Department	Eastern Cape Office of the Premier
Provincial Department	Mpumalanga Office of the Premier
Provincial Department	KZN Office of the Premier
Provincial Department	Free State Department of Agriculture
Provincial Department	Gauteng Department of e-Government
Provincial Department	Western Cape Department of Treasury

2.2 Data Triangulation

A key aspect of the research approach involved the cross validation and triangulation of results to ensure robust research findings. The image below describes that information gathered from any data source (example, 1) may be assessed and validated against any other data source (data sources 2 or 3), and vice versa to ensure findings are consistent and valid. Should any discrepancies arise, for example a finding in the interview may contradict the findings in surveys, further analysis is performed to determine reasons for the discrepancy. This information enforces the notion that a thorough study is delivered.

Survey Finding 2-2: Data Triangulation



2.3 How to Read and Interpret Survey Results

As explained in section **2.1.1**, quantitative results were obtained through surveys. The survey questions were predominantly based on a 5-point Likert scale (with 5 denoting the most positive response and 1 indicating the most negative response). Likert-type or frequency scales use fixed choice response formats and are designed to measure attitudes or opinions (Bowling, 1997). An example of a 5-point Likert scale used in this report is the scale used to measure the extent of a state, ranging from “not at all” the case to “extensively” the case (see below), for instance the extent to which PSETA stakeholders use ET/4IR products and services within their institution. The reason for choosing such a rating system was because responses are easily quantifiable and amenable to computation of some mathematical analysis (LaMarca, 2011).

The extent of a state is measured directly or through assessing agreement/disagreement with statements, as seen below.

Likert Scales of Extent				
Not at All (1)	Minimally (2)	Substantially (3)	Significantly (4)	Extensively (5)
Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)

The graphs presented throughout this report measure the percentage of respondents who selected a specific option (1-5) over the total number of respondents for that question. The table below presents an example on how the survey results are analysed:

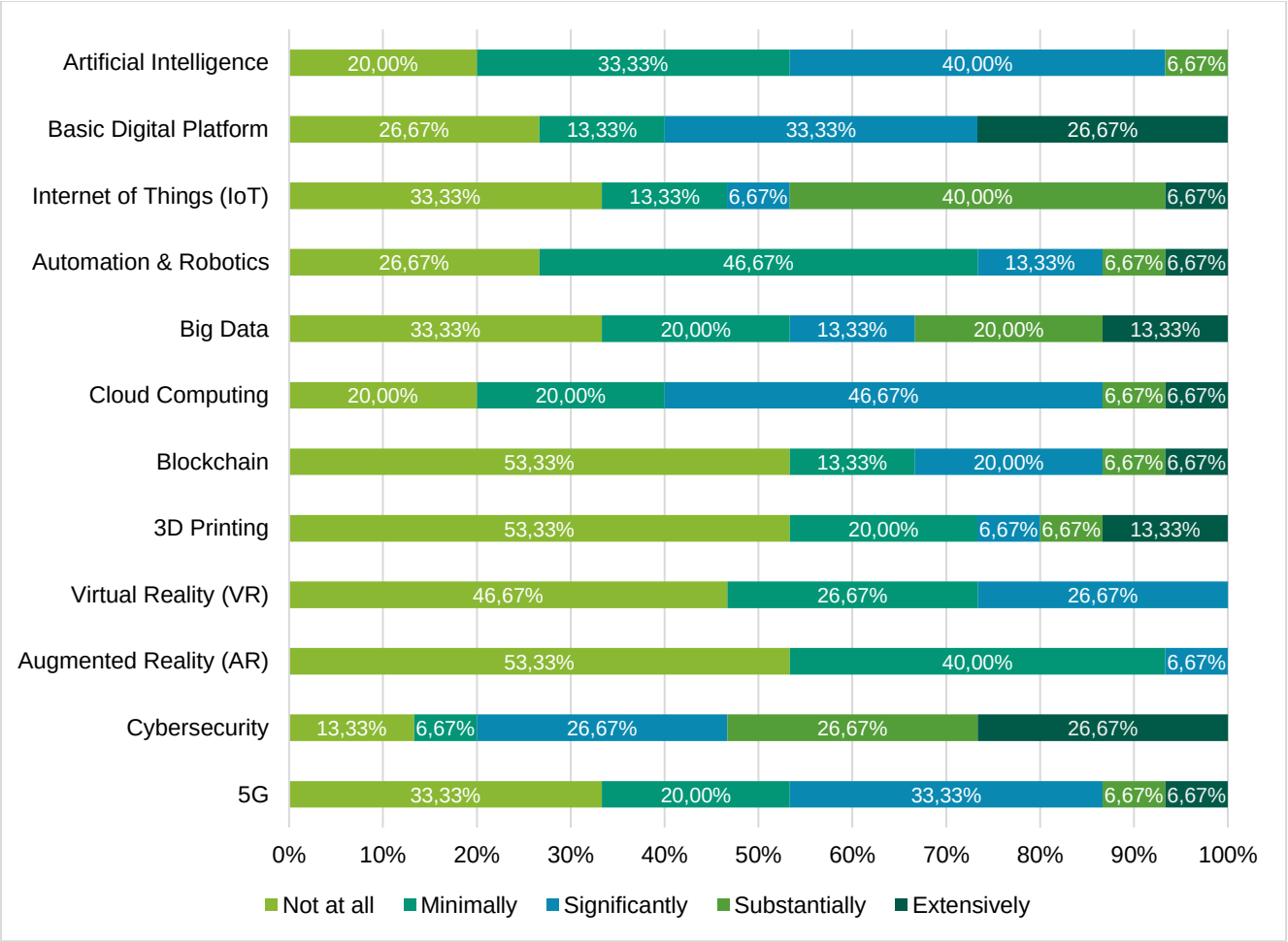
Survey Finding 2-3: Illustration-Sample Survey Results

To what extent does your organisation use the following emerging technologies?											
	Not at all		Minimally		Significantly		Substantially		Extensively		Total
Artificial Intelligence (AI)	20.00%	3	33.33%	5	40.00%	6	6.67%	1	0.00%	0	15
Basic Digital Platform	26.67%	4	13.33%	2	33.33%	5	0.00%	0	26.67%	4	15
Internet of Things (IoT)	33.33%	5	13.33%	2	6.67%	1	40.00%	6	6.67%	1	15
Automation & Robotics	26.67%	4	46.67%	7	13.33%	2	6.67%	1	6.67%	1	15
Big Data	33.33%	5	20.00%	3	13.33%	2	20.00%	3	13.33%	2	15
Cloud Computing	20.00%	3	20.00%	3	46.67%	7	6.67%	1	6.67%	1	15
Blockchain	53.33%	8	13.33%	2	20.00%	3	6.67%	1	6.67%	1	15
3D Printing	53.33%	8	20.00%	3	6.67%	1	6.67%	1	13.33%	2	15
Virtual Reality (VR)	46.67%	7	26.67%	4	26.67%	4	0.00%	0	0.00%	0	15
Augmented Reality (AR)	53.33%	8	40.00%	6	6.67%	1	0.00%	0	0.00%	0	15
Cybersecurity	13.33%	2	6.67%	1	26.67%	4	26.67%	4	26.67%	4	15
5G	33.33%	5	20.00%	3	33.33%	5	6.67%	1	6.67%	1	15

It may be noted from the above that 5 respondents indicated that they do not utilise Big Data at all. Overall, 15 businesses responded to this question, with particular regards to Big Data. Therefore, the extent to which Big Data products are not used in the sector is 33.33% (=5/15). Conversely, Big Data products are used, to varying extents, by 66.66% of businesses.

The results above would then be presented graphically as follows:

Survey Finding 2-4: Illustration-Sample Graph



Source: PSETA, Emerging Technologies, Survey, 2020

2.4 Research Challenges

During the data collection phase of the project, three major challenges that hampered the data collection process were encountered. Although these issues were overcome by adapting the research design, it is worth noting these to inform the research approach in future.

Table 2-3: Research Challenge Table

	Research Challenge	Response to Challenge
1	**Inaccurate Stakeholder Information and Unavailability of Stakeholder Contact Details** The databases containing National and Provincial Departments, Office of the Premiers contact details had invalid contact details, resulting in unsuccessful	• With regard to the contact details being either incorrect or not available at all, the project team undertook additional research to find these contact details, where they were

	Research Challenge	Response to Challenge
	attempts to contact some stakeholders. This may be attributed to contact details such as email addresses being deactivated after some time, for instance if an employee exits an organisation. It is recommended that the SETA regularly updates its contact databases.	publicly available, or through the project team's own networks • Department managers or supervisors were asked to put the project team in touch with the relevant stakeholders
2	**Server Permission Rule Violations** Firewalls and server rules blocked the survey link and some emails in contacting stakeholders due to server permission violations which resulted in fewer participants completing the survey.	• The surveys and communications were resent through a different email address in order to try and reach participants.
3	**Stakeholder Unavailability/COVID-19 to Participate in Study** Some stakeholders, due to COVID-19 where not available for an interview due to workplace restrictions regarding their accessibility to work emails. In at least 4 engagements the participant either mentioned that they are not fit enough (not well or COVID positive) to take part in the interview and that their Departments had to be sanitised and were not able to participate.	• To overcome the not well or restrictions placed by COVID on stakeholder's engagement with the project team, a request to contact their supervisor was made unsuccessfully. • We also contacted the Department with most landline numbers not being answered, presuming that some Departments are working remotely.

3 Literature Review

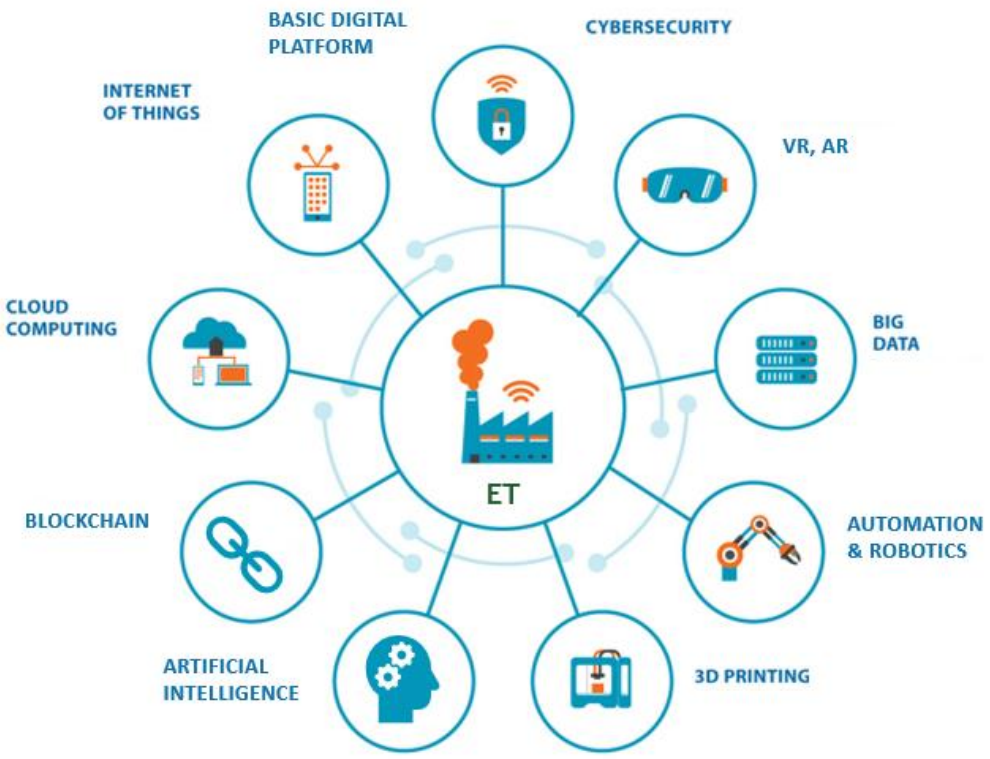
This section includes a literature review which considers the role of ET and 4IR. It explains the current context and the drive towards 4IR adoption taking into account key policies and stakeholders. Furthermore, the findings from international case studies (Brazil, India and Indonesia) have transformed their Public Services Sector successfully extracting key lessons learnt.

3.1 Categorising Emerging Technologies

This section considers ET in the Public Services Sector and the impact thereof on employment, skills and service delivery. This explaining certain technical concepts and definitions (for example, Big Data, using large sets of structured and unstructured data in finding trends and patterns i.e. dynamic electricity pricing and real-time adjustments in the provision of electricity supply to meet demand, at the municipal, provincial or national level).

In this study, “ET” and “4IR” are used interchangeably, with the understanding that the ET studied are all 4IR technologies. These technologies include the following:

Figure 3-1: Emerging Technologies



Source: Adapted from: (IEEE, n.d.)

The ET above are defined as follows:

1. **Artificial Intelligence (AI)**: Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem-solving. The ideal characteristic of artificial intelligence is its ability to rationalise and take actions that have the best chance of achieving a specific goal (Investopedia, 2020).
2. **Basic Digital Platform:** A Basic Digital Platform refers to an online system that provides for the interaction between at least two different parties, who can also interact with the platform and content. An example of this is a Central Supplier Database, Shared Services Platform, Online Applications or e-Learning system (IGI Global, 2020).
3. **Internet of Things (IoT)**: Refers to a network comprised of physical objects capable of gathering and sharing electronic information. IoT includes a wide variety of “smart” devices, from industrial machines that transmit data about the production process to sensors that track information about the human body (Investopedia, 2020).
4. **Automation and Robotics**: Automation refers to using computer software, machines, or other technology to carry out a task which would otherwise be done by a human worker. Related to that, robotics is a branch of engineering and science that deals with the design, construction, operation, and use of robots, as well as computer systems (Hankiewicz, 2018).
5. **Big Data**: Big data refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety or scope of the data points being covered. Big data often comes from multiple sources and arrives in multiple formats (Investopedia, 2019)
6. **Cloud Computing**: Cloud computing is the delivery of different services through the Internet. These resources include tools and applications like data storage, servers, databases, networking, and software (Investopedia, 2019).

7. **Blockchain**: Blockchain is a distributed ledger technology (DLT) that allows data to be stored globally on thousands of servers – while letting anyone on the network see everyone else's entries in near real-time (Mearian, 2019).
8. **3D Printing**: 3-D printing is an additive manufacturing process which creates a physical object from a digital design, by laying down thin layers of material — in the form of liquid or powdered plastic, metal or cement — which is fused together (Investopedia, 2018).
9. **Virtual Reality**: Virtual reality (VR) refers to the computer-generated simulation in which a person can interact within an artificial three-dimensional environment using special electronic devices, such as special goggles with a screen or gloves fitted with sensors. In the simulated artificial environment, the user is able to explore the various artefacts and proceedings as they might in the real world (Investopedia, 2018).
10. **Augmented Reality (AR)**: Related to VR, augmented reality is an enhanced version of the real physical world through the use of visual elements, sound or other sensory stimuli. Amid the rise of data collection and analysis, one of augmented reality's primary goals is to highlight specific features of the physical world, increase understanding of those features and derive smart and accessible insight that can be applied to real-world applications (Investopedia, 2018).
11. **Cybersecurity**: Cybersecurity refers to the measures taken to keep electronic information private and safe from damage or theft. It is also used to make sure these devices and data are not misused. Cybersecurity applies to both software and hardware, as well as information on the Internet, and can be used to protect everything from personal information to complex government systems (Investopedia, 2019).
12. **5G**: 5G is the 5th generation mobile network. It is a new global wireless standard after 1G, 2G, 3G, and 4G networks. 5G enables a new kind of network that is designed to connect virtually everyone and everything together including machines, objects, and devices. 5G wireless technology is meant to deliver higher multi-Gbps peak data speeds, ultra-low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to

more users. Higher performance and improved efficiency empower new user experiences and connects new industries (Qualcomm, 2020).

3.2 Current Context: A Drive Towards Digitisation

The current context sets the narrative for why PSETA has focused this report on ET and its implications from a skills and technology-use perspective. This is where the Government recognises the emergence of new technologies and the impact they may have on the Public Services Sector through a National agenda and policy-driven approach from the top.

Explaining the Public Services Sector's position on 4IR and the technologies thereof, the then Department of Public Service and Administration (DPSA) Minister, Ayanda Dlodlo, maintained that 4IR is here and "we cannot run away from it [4IR], we will not be spared" (Dlodlo, 2018). Speaking at the 2018 Statement of the Nation Address President Cyril Ramaphosa pronounced on the important of embracing and capitalising on 4IR (TIMESLIVE, 2018):

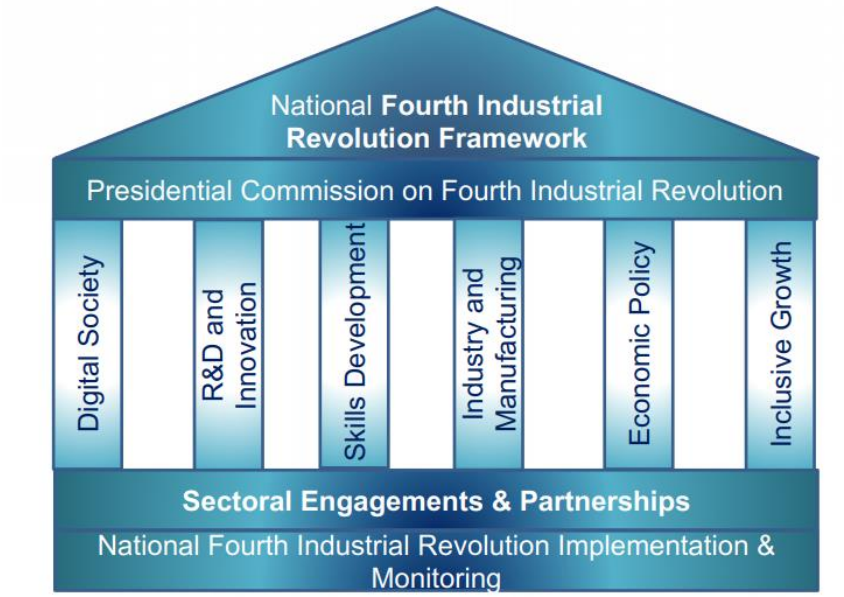
> *"Our prosperity as a nation depends on our ability to take full advantage of rapid technological change. This means that we urgently need to develop our capabilities in the areas of science, technology and innovation. We will soon establish a Digital Industrial Revolution Commission, which will include the Private Sector and civil society to ensure that our country is in a position to seize the opportunities and manage the challenges of rapid advances in information and communication technology. The drive towards the digital industrial revolution will be underpinned by the availability of efficient networks."-Cyril Ramaphosa, 2018*

3.2.1 Presidential 4IR Commission

To better articulate government's response to 4IR, the Presidential Commission on the Fourth Industrial Revolution was convened with the intention to "coordinate the development of South Africa's National response action plan to deal with the 4IR" (South African Government, 2019). The Commission was led by the Department of Telecommunications and Postal Service. The commission is looking into the Digital Society, Research and Development (R&D) and Innovation, Skills Development, Industry and Manufacturing, Economic Policy and Inclusive Growth. These key focus

areas are anchored by sectoral partnerships and the implementation of a National strategy that will be monitored. The figure below demonstrates this framework.

Figure 3-2: Presidential Commission on 4IR



Source: (DTPS, 2018)

The custodian of the 4IR Commission and initiative is now the Department of Communications and Digital Technologies (DCDT), following the merger of the Department of Communications (DOC) and the Department of Telecommunications and Postal Services (DTPS). The Department's strategic outcome-orientated goals are to (National Government of South Africa, 2019):

> *"…enable the maximisation of investment in the Information and Communications Technology (ICT) sector and create new competitive business opportunities for the growth of the ICT industry for socio-economic development; ensure that ICT infrastructure is accessible, robust, reliable, affordable and secure to meet the needs of the country and its people; accelerate the socio-economic development of South Africans and facilitate the building of an inclusive information society through partnerships with business and civil society, and the three spheres of government; improve departmental performance and enhance the role of ICT State-Owned Enterprises (SOEs) as the delivery arms of government; and contribute to the global ICT agenda prioritising Africa's development."*

South Africa is engaged at several multilateral levels in order to improve competitiveness. These include: The African Telecommunications Union, the BRICS Working Group on the 4IR, G20 initiatives and WEF/ITU African Centre for Digital Transformation.

There is currently a fragmentation within the innovation ecosystem. The response to 4IR will need to be a “robust, multisectoral approach involving government and various stakeholders such as business, academia and civil society, including entrepreneurs” (Dlodlo, 2018).

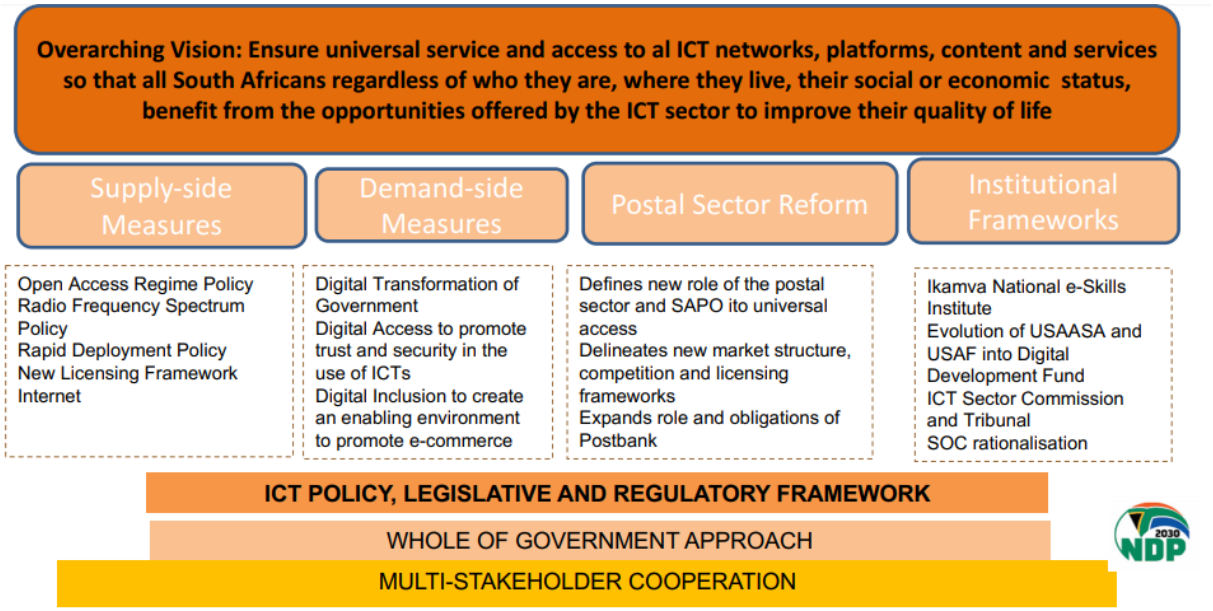
3.2.2 Policy Implications

Three central policies have a bearing on the approach to 4IR. These policies are the 2012 National Development Plan (NDP), the 2013 National Broadband Policy and the 2016 National Integrated ICT Policy White Paper. Furthermore, the Sustainable Development Goals (SDGs) and the National e-Strategy Focus are additional policies that see 4IR as an enabler towards inclusive growth in both Private and Public Services Sectors.

3.2.2.1 National Developmental Plan (NDP)

The NDP aims to eliminate poverty and reduce inequality by 2030. According to the plan, South Africa can realise these goals by drawing on the energies of its people, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leadership and partnerships throughout society (National Planning Commission, 2012). With regards to technology, the NDP pronounces as follows:

Figure 3-3: NDP on Technology



Source: (National Planning Commission, 2012)

Below is an extract from the NDP focusing on technological enabling factors towards the 2030 Goals:

> *"South Africa needs to sharpen its innovative edge and continue contributing to global scientific and technological advancement. This requires greater investment in research and development, better use of existing resources, and more nimble institutions that facilitate innovation and enhanced cooperation between public science and technology institutions and the Private Sector. The high domestic cost of broadband internet connectivity is a major hindrance. All South Africans should be able to acquire and use knowledge effectively. To this end, the institutional arrangements to manage the information, communications and technology (ICT) environment need to be better structured to ensure that South Africa does not fall victim to a "digital divide"* (National Planning Commission, 2012).

3.2.2.2 National Broadband Policy (NBP)

The National Broadband Policy (NBP) provides a vision and long-term strategy that can begin to be implemented immediately in catalysing broadband connectivity in South Africa. Furthermore, the policy outlines a short-term plan that identifies the National departments and agencies responsible for setting the plan in motion. The NBP

aims to ensure universal service and access to reliable, affordable and secure broadband services by all South Africans, prioritising rural and under-serviced areas and stimulating economic growth.

Below is an extract of the NBP:

> *"The NBP, operationalises the NDP and the New Growth Path which both identify the knowledge economy as one of the drivers of job creation…Additionally, this policy gives effect to the Constitution of South Africa by creating the conditions in a modern electronic world "to improve the quality of life of all citizens and free the potential of each person" and, in doing so, enables equality in the rights, privileges and benefits of citizenship, including the guarantees of freedom of expression and association in the Bill of Rights. This aligns with the declaration by the Human Rights Council of the United Nations General Assembly that access to the internet is a basic human right which enables individuals to "exercise their right to freedom of opinion and expression"* (Dept. of Communications, 2013).

3.2.2.3 National Integrated ICT Policy White Paper

Information and Communication Technology (ICT) can play a key role in facilitating the objectives of the NDP with the National Integrated ICT Policy White Paper, setting out how Government will realise this potential. It is premised on furthering the Constitutional objective of improving "the quality of life of all citizens" and freeing "the potential of each person".

Below is an extract from the Whitepaper:

> "*Convergence is therefore at the heart of this White Paper…It recognises that the disruptions in the traditional sectors require policy approaches to be adapted to ensure that Government's vision is realised. It has therefore adopted a holistic approach, dealing, for example, with both supply and demand-side issues to facilitate universal access to ICTs, as well as postal sector transformation and industry growth. It also recognises that the policies need to take into account the needs of sectors such as education, justice, health and welfare so that digital technologies can support their development goals, while recognising that*

convergence raises new threats to rights such as those of privacy and security" (DTPS, 2016).

3.2.3 Key Stakeholders

Given the above-mentioned policy frameworks, this section considers key stakeholders, partnerships and resources allocated towards innovation in South Africa. Key Public Services Sector stakeholders include Government Departments and their Agencies.

In conjunction with the 4IR Presidential Commission and the Department of Communications and Digital Technologies (DCDT), other key innovation policy implementations are directed by the Department of Science and Innovation (DSI), assuming leadership for innovation policy design, development and implementation.

Raphasha (2015) proposes that the following Public Services Sector stakeholders are important in realising an impactful technology and innovation landscape, within and outside the Public Services Sector:

- DSI's responsibilities for vertical co-ordination include a number of government agencies and research councils.
- Key agencies and councils include the:
    - National Research Foundation (NRF),
    - Technology Innovation Agency (TIA),
    - Council for Scientific and Industrial Research (CSIR),
    - Human Sciences Research Council (HSRC).
        - All of these agencies and councils have their own performance indicators, agreements, and governance bodies appointed by the DSI.
- The Department of Trade and Industry (DTI) is a significant funder of technology, research and innovation, and via other agents.
- Key innovation programmes for funding by the DTI:
    - Technology and Human Resources for Industry Programme (THRIP) managed by the National Research Foundation;

- Support Programme for Industrial Innovation (SPII) managed by the Industrial Development Cooperation (IDC) (now moved to the Department of Economic Development); and
- Small Enterprise Development Agency (SEDA).

- The DTI's responsibilities include aspects of technology-related innovation and entrepreneurship, often on a shared basis with DSI.

3.3 Findings from Case Study Literature Reviews

Findings from case studies and literature reviews, provided a wider understanding of ET adoption, implementation and skills impacts on an international level. This also complements the current context and research findings by fully understanding the role ET can have in various circumstances in the Public Services Sector.

There is a global technological movement with a need for a greater and wider adoption of ET. This has become solidified with the introduction of 5G, the fifth-generation wireless technology, which is expected to be more effective, more efficient and as much as 100 times faster than 4G (Corfe, 2018).

These technologies have the potential to enable real productivity changes and studies that have been conducted have highlighted the capability of advancements such as artificial intelligence and the Internet of Things (IoT) to benefit employers and employees alike.

A study into introducing ET into the Public Services Sector to optimise government service provision and its impact on skills, requires an understanding of what technological advancements have been attempted already and their outcomes.

3.3.1 Technology and Government

Government has always been seen as averse to change, a slow-moving bureaucracy that is far behind the Private Sector in its adoption of ET (Schoonraad & Mthethwa, 2018).

There have, however, been significant changes in the past several decades in the implementation of new technologies in the Public Services Sector locally and globally (Simons, 2018).

Digital government or e-Government is the implementation of technology-enabled government innovations while simultaneously transforming the organisational structures, service provision, policy and governance systems.

In the late 1990s and early 2000s, e-Government 1.0 was introduced in the Public Services Sector. This was the initial application of world wide web technology intended to replace paper transactions. Government organisations started investing in ICT which did not take off as intended due to operational processes remaining the same (European Union, 2019).

This was followed by e-Government 2.0, which aimed at using technology to create open-source platforms that enable government, citizens, and other stakeholders to interact. This assisted government to facilitate interaction and positioned government as a provider of open data, web services, and platforms as an infrastructure.

e-Government 3.0 (the “smart” government), in the mid-2010s was powered by innovations related to open and big data, administrative and business process management, the Internet of Things (IoT) and blockchain. It was also about policy innovation: improving sustainability, process and resource optimisation, affordability and appropriateness of policies.

Finally, e-Government 4.0 was introduced – a transformed, adaptable and citizen-driven government. The United Nations increasingly sees e-Government 4.0 as a tool for building effective, inclusive and accountable institutions to support policy making and service delivery for the sustainable development goals.

The goals of the above innovations have proven to be more effective in theory than practice. Despite the interest in Artificial Intelligence (AI) and related technologies, as of early 2019, many government programmes did not progress beyond at e-Government 1.0 or 2.0 (European Union, 2019).

Governments are facing increasing pressure to improve, and even totally transform, by finding ways for more efficient service provision and more than ever, need to find ways to mitigate the risk of being left behind as technology sweeps the rest of the world into 5G and beyond.

Yet the specific context of a country is an important factor in the capability to effectively implement ET. Developed countries can generally focus on the potential of new technologies to enhance competitiveness, wealth and quality of life. Developing

countries, however, often face huge challenges making even the most basic services accessible to the public (World Bank Group, 2018). These types of implementation gaps make it difficult for these countries to accommodate rapid and disruptive changes that the introduction of new technologies brings.

Transitioning to technological advancements that enable service provision often requires closing these gaps by addressing important reform precursors such as improving policy-making and policy coordination processes within government, strong leadership support, enabling infrastructure, and building institutional capacity.

Rapid technological change simultaneously poses new challenges for policy-making. They can perpetuate inequalities, affect labour markets and raise ethical questions and as a result, overtake the capacity of governments and society to adapt. The next section outlines some smart urban platforms used by governments to streamline services and processes.

3.3.2 Smart Urban Platforms: Case Studies

Roblek et al (2019), outlines best practices and case study examples of smart urban platforms which enable stakeholders in e-services and participation. The below table which involves an interactive partnership at the National, regional and local state level with strong parentships at the Private Sector level.

Table 3-1: Smart Urban Platforms Examples

State/region/city	Type of e-Government	Name of service/ platform	Purpose
Australia/New South Wales	Voting system	iVote (web platform)	Enable to the citizens to vote online or by phone for the state election 2019
Austria/Vienna	e-service, petitioning, election card application (in option for now)	Der digitale Ausweis (mobile application and web platform)	Allows citizens' business registration, car registration, and city petitioning
Estonia/local government (cities and parishes)	e-participation, e-voting, e-participative	Volis (web platform and mobile application)	Paperless document management and processing; different possibilities for participation in meetings

State/region/city	Type of e-Government	Name of service/ platform	Purpose
	budgeting (only in Tartu)		including virtual participation; E-voting ID card; Automatic self-writing session protocol; Session webcast and recordings archive; possibility to do paperless all participatory budgeting processes and use polls where secure; Possibility to do paperless all participatory budgeting processes and use polls where secure voting by e population is provided
Estonia/local government (cities and parishes)	Open data platform	KOVTP	Open source service portal for local governments is a website content management solution, turning a conventional website into a service portal
Finland/state level	Open code platform	The citizens' initiative	It gives citizens the opportunity to consider their proposal by the Finnish parliament. A citizens' initiative may include a bill or a proposal that they should start the process of drafting the bill. The initiative may also concern the amendment or repeal of a valid act
Finland/state level	e-deliberative democracy	Otakantaa; Lausuntopalvelu	Otakantaa can be used to create questionnaires and discussions during the drafting process; Lausuntopalvelu is intended to collect official requests for online statements, which is always necessary before the government sends the bill to the parliament

State/region/city	Type of e-Government	Name of service/ platform	Purpose
Italy/Emilia Romagna	e-participation	"io Partecipo +" (web platform)	In the framework of the preparation of certain regional political decisions, citizens have the opportunity to engage in the process of participating in design by joining discussions in "virtual rooms". Each "virtual square" is intended for the cooperation process and is configured as a public space in which people can exchange information, discuss ideas and propose solutions
Russia/Moscow	e-participation, e-voting	Active Citizen platform app and web	It allows residents of the Russian capital to allow citizens to directly weigh in on non-political city decisions—things like setting speed limits, plotting bus routes, and naming subway stations. A project to implement blockchain in its electronic voting system based on Ethereum smart contracts platform. First use September 2019 elections to the Moscow City Duma
South Korea/Seoul	e-participation	m-Voting and e-Voting	This participatory policy allows citizens to vote not only on policy issues, but also on any ordinary city life issues

Source: (Roblek et al, 2019)

3.3.3 Case Study Analysis

The three case studies outlined below were selected based on their relevance to the study as research indicates that responses of countries to ET are unique in many respects.

The chosen case studies highlight the following factors:

- All initiatives to technological change were facilitated by first addressing precursors to reforms;
- Each case study involved intentional and specific efforts to adopt technology to improve service efficiency;
- Each study required the leadership to have a balance between knowledge of the government ecosystem and faith in technological adaptation and innovation;
- All case studies required a shift in the traditional tendency to see a distinction between Government and the Private Sector, as the Public Services Sector provided the skills to navigate the government complexities and the Private Sector brought invaluable knowledge around processes, technology and safeguards;
- All reform initiatives followed a holistic approach that develops people, business and technology simultaneously; and
- Every case study included focused efforts on obtaining staff buy-in. Hard (technology) and soft skill (culture, building trust and motivation) training was a key component in ensuring staff embraced and were committed to on-going training and development.

The case studies chosen further represent good practices of three developing countries, (Brazil, India and Indonesia), that are useful to incorporate.

These countries provide good practices that South Africa can emulate or use as goal posts.

Much like South Africa, Brazil, India and Indonesia face similar challenges with their human capital and lags in capabilities related to digital skills, engineering, critical thinking and other key areas which are pivotal for future growth.

Table 3-2: Selected Case Studies with Best Practices

Country	Reactions to 4IR	Best Practices
Brazil	• The municipal offices in Manaus, Brazil were facing huge challenges in 2012 with low finances and growing debt, exacerbated by a weak tax collection system • Poor management, manual processes and poor staff motivation added to these problems • A new mayor was elected in 2013 with a different management style and a vision to treat public services as a business that needed to earn revenue that could be invested in public services • His goal was to introduce technological changes to the procurement system and to the communication systems • The head of the secretariat placed new technologies at the centre of all the secretariat's reforms, and also took over the city's IT department to facilitate the modernisation and streamlining of processes across the city government • While other mayors gave positions to their supporters, he procured the services of someone who had experience in the Private Sector and an ambitious vision to make Manaus one of the top 5 best managed cities • His priority was to change the culture by contracting business consultants to train the managers and lead workshops that enabled the staff to be equipped for change and embrace it • Some of the staff initially resisted change but training that focused on improving how to build trust, credibility, and respect from staff, and workshops to build pride and camaraderie among civil servants helped them become more comfortable with change • While staff were being trained, the secretariat started reforming its IT infrastructure and a goal was set to increase revenue by 10% each year	A strong leader with an enabling vision that embraces technological change A responsive and responsible leader is a huge catalyst for change Ensure context specific strategies The leadership team should have a common vision and mission Appoint a central body of suitably qualified and skilled stakeholders to provide an oversight role The right trainers and training will ensure a culture that embraces change Contracting technical experts will ensure that staff are properly skilled to manage technological change It is vital that training has a soft skills component that helps staff embrace ET A committed, high performing staff enables reforms The right incentives ensure a shared commitment to achieving goals Reform initiatives need to follow a holistic approach that develops people, business and technology simultaneously Creating partnerships and learning from others'

Country	Reactions to 4IR	Best Practices
	• Employees would get an extra month's salary at the end of the year if this goal was achieved • The management team investigated every department and every process to find ways to increase revenue • The team sought advice from another state which had already gone through the process of introducing an electronic procurement system • Staff signed agreements to action plans to achieve goals they set up with their managers that were linked to their salaries • The performance-based incentive changed the day-to-day culture and ensured that all staff were willingly involved in the change • In 2017, Manaus was ranked first of all Brazilian state capitals and 33rd of all Brazilian municipalities in the FIRJAN Fiscal Management Index from its 1,200th position 2013 • Manaus is now assisting other states with implementing the electronic procurement and communication systems (World Bank Group, 2018)	experience accelerates the pace of reforms Focused efforts on obtaining staff buy-in will ensure they are committed to on-going training and development Take into consideration country specific contexts when researching and replicating successful reforms.
India	• Government discussions about introducing a National identity card in India began to address National security issues and prevent money laundering • Government was faced with multiple problems such as large-scale poverty and corruption with most of the population without identity cards so it would require a high economic and political investment • A Multipurpose National Identity card (MNIC) project was proposed in 2007 after research was conducted in other countries with similar initiatives such as Peru, Thailand, Rwanda and Pakistan, a pilot programme was implemented • This failed as people needed to prove identity to get a card and there was a lot of political opposition	Technological change is facilitated by first addressing precursors to reforms Team composition is crucial to enabling reforms The project team needs a balance between knowledge of the government ecosystem and faith in technological adaptation and innovation The team should be diverse with domain-specific competency Investing in skilled consultants enables important upskilling of staff

Country	Reactions to 4IR	Best Practices
	• In 2004, a new government came into power and a new authority was created called the Unique Identification Authority of India (UIDAI) • It was established by an executive order in 2009 and then by statutory backing through legislation in the Parliament in 2016 • The Chairman of UIDAI introduced India's biometric identity programme, Aadhaar (meaning: 'foundation'), in 2010 • A highly skilled team of technological experts were sourced which enabled upskilling of staff • A cost benefit analysis was conducted which concluded that Aadhaar would yield an internal rate of return in real terms of 52.85% to the government • Despite this, rolling out the system to more than a billion people would be a huge challenge • Aadhaar uses a significant amount of technology from biometrics and iris scanning to encryption software and central data repository • The Aadhaar Payments Bridge System (APBS) that allows the government to directly transfer subsidies to people's bank accounts, the Aadhaar Enabled Payment System (AEPS) fosters digital payments across banks and an Aadhaar-based voter management system were also introduced • Due to the scale of Aadhaar which has been rolled out to 1.2 billion people, much of the work was outsourced, creating employment for thousands of people • Aadhaar has made tremendous progress with 16% of the world's population holding an Aadhaar number • This makes Aadhaar the world's largest biometric ID programme.	Outsourcing activities creates employment and enables sustainability Take into consideration country specific contexts when researching and replicating successful reforms Investing in a marketing team is key to managing optics and getting the public and politicians invested in the idea Government policies are key to enabling change Ensure strong government change The traditional tendency to see a distinction between government and the Private Sector should be avoided with technological reforms as an understanding of government and technology skills are both vital Ensure quality checks and institutional checks are put in place Enlisting external agencies assisted with training and development of staff Ensuring stakeholder involvement enabled investment in the change and introduced inclusivity Timing and political backing is crucial to implementing technological change

Country	Reactions to 4IR	Best Practices
	• Since September 2010, when the world's first Aadhaar number was issued, India has covered 99% of its total adult population over the age of 18. (Misra, 2019)	Ensure comprehensive research, planning and processes
		The political establishment needs to be invested in the idea to bring about reform from the ground up
		Branding and marketing the reform involves understanding what people need to know to embrace the idea
Indonesia	• In 2014, the Indonesian Ministry of Finance began piloting its new Financial Management Information System (FMIS) to improve efficiency, accountability and transparency of its public financial management • However, line ministries and agencies relied on standalone systems for reporting so an online monitoring system called SPAN was developed which extracts data from the FMIS and are uploaded to a web-based platform, called Online-Monitoring Span (OM-SPAN) as well as a an OM-SPAN mobile application using open source software allowing all stakeholders to monitor the budget implementation process and produce their own reports as needed • A dedicated project team from the Ministry of Finance was responsible for the project • SPAN was developed by referring to several developed countries that have successfully implemented similar programs, for example: Australia, America and Canada, but still paying attention to the cultural uniqueness and existing processes in Indonesia • SPAN is a vital component of a project called the Government Financial Management and Revenue Administration Project (GFMRAP), supported by many donors, including the World Bank, the Government of	Government policy are key to enabling change
		Strong, dedicated stakeholder support is key to instituting reforms
		Donor support enables sustainability
		An intuitive system (user friendly) saves training time and costs
		Technology can be utilised to facilitate training such as YouTube videos and mobile chat functions
		The traditional tendency to see a distinction between government and the Private Sector should be avoided with technological reforms as an understanding of government and technology skills are both vital
		Though information technology is an enabler in both, the improvement in performance is achieved through changing the institutional culture.

Country	Reactions to 4IR	Best Practices
	Canada, the European Union, and the Government of Switzerland • In April 2017, the functionality of OM-SPAN was extended to also capture spending data of some transfer funds at the sub-National level • The online monitoring system has given more than 100,000 government officials access to relevant data, and has reduced the time spent reconciling transactions and generating reports • The system was designed at a fraction of the cost that would have been the case under traditional approaches relying on international software licenses • The OM-SPAN system was designed to be intuitive, and most line ministry officials required little training to use the system • Staff learned very quickly via small training sessions at local treasury offices for spending units • The MOF also created videos explaining how to use the OM-SPAN website and mobile application, and uploaded them to YouTube • Officials who had difficulty accessing information are able use a chat function within the mobile application to get live support from a treasury official • As of 2018, the government is in the process of introducing several new reforms, including an in-house developed cloud-based financial information system for users of all line ministries and spending units that will be interfaced to SPAN • SPAN is now being used by Ministry of Finance at DG Budget and DG Treasury headquarters, including 182 Treasury services offices, and 33 Treasury Kanwil offices all over Indonesia with more than 3,600 users, serving 24,000 spending units. (World Bank Group, 2018)	Utilising innovative versus traditional approaches to technology advancements can result in huge cost savings Timing and political backing is crucial to implementing technological change Take into consideration country specific contexts when researching and replicating successful reforms

Additional literature consulted in the compilation of this Report can be found in the Appendix **11.1**, which summarises key information relating to relevant literature to inform the Research Report and for further insights for the reader. The table indicates

the key themes of each piece of literature and provides a short summary of the literature.

3.3.4 Skills Impact

If the world is to attain the 2030 Agenda for Sustainable Development, adopted by world leaders in 2015, which aims to “leave no one behind”, organisations will have to adopt as broad and ambitious an agenda to incorporating ET (UNCTAD, 2018).

While technological change can revolutionise multiple areas in Public Services Sector service provision, it can lead to labour displacement, and unemployment resulting in the need for social protection measures to mitigate these negative effects. The Asian Development Bank (ADB) recently published a report which observes that, of 12 previous major studies into the impact of technologies on work, while predictions for wealthy countries diverged, the 4 that examined developing countries expect a downward pressure on both wages and employment (ADB, 2018).

Studies have shown that trying to estimate the total numbers of jobs lost to automation is difficult to predict and that technological change damages not the numbers but the nature of employment, as has been evidenced in wealthy countries. This detracts from new jobs created by new technologies, the improvement of existing jobs by the complementary use of technology or the existing jobs that unemployed workers may be able to move into, as a result of automation (Oxford, 2018).

ET have the potential to make work more inclusive, flexible and less tedious if they are approached in ways that maximise benefits while instituting social protection for those adversely affected. This entails gaining the support of the workforce and proactively enhancing skills to meet the skills in demand that will continue to change as technology evolves. If employees believe that technology has the potential to enhance their lives, they are more likely to embrace it (Corfe, 2018).

4. Impact on Government

This section highlights the impact ET have had on the Public Services Sector. The sub-sections explore the rate at which government is digitising and moving towards an e-Government, and what that means from a South African perspective. This section considers the various e-Governmental model types with some literature on successful implementations. In this section, the research findings are discussed in detail from the consultations, that includes both qualitative and quantitative feedback. Recommendations and thematic trends are, thereafter, presented in Section **8**: *Key Findings and Recommendations.*

4.1. Government and Digitisation

Schoonraad & Mthethwa note that "the Public Services Sector has always lagged behind in adopting new technologies and approaches" (2018). This statement is given credence by the current focus and understanding of "ET" and "4IR". Much of the response to the National Development Plan's (NDP) identification of ICT as a "critical enabler of economic activity" in South Africa has focussed on transitioning from manual, paper-based processes to the computer and internet (Simons, 2018). This has taken form in developments such as:

1. **Smart Cities** Where cities are strategically planned, integrated and digitised, and basic services are made easily accessible by technology. This is premised largely on increasing connectivity by introducing technologies such as LTE internet and free basic Wi-Fi in public areas (Tau, 2018), (Mtungwa, 2018).
2. **e-Services** where government services are taken online. The Gauteng Provincial Government is the first and only Provincial Government to have a Department of e-Government. By collating different Provincial Government Departments and their offerings on a single website, the Department has created a single point of access for citizens and employees to all Gauteng Provincial Departments. In addition, e-Services include the introduction of an Employee Self-Service (ESS) portal to "reduce the costs and time of running governments back office services" (Ngobeni, 2018). The ESS incorporates aspects such as the Performance Management and Development System (PMDS), and is envisaged to be available as a mobile application which all GPG

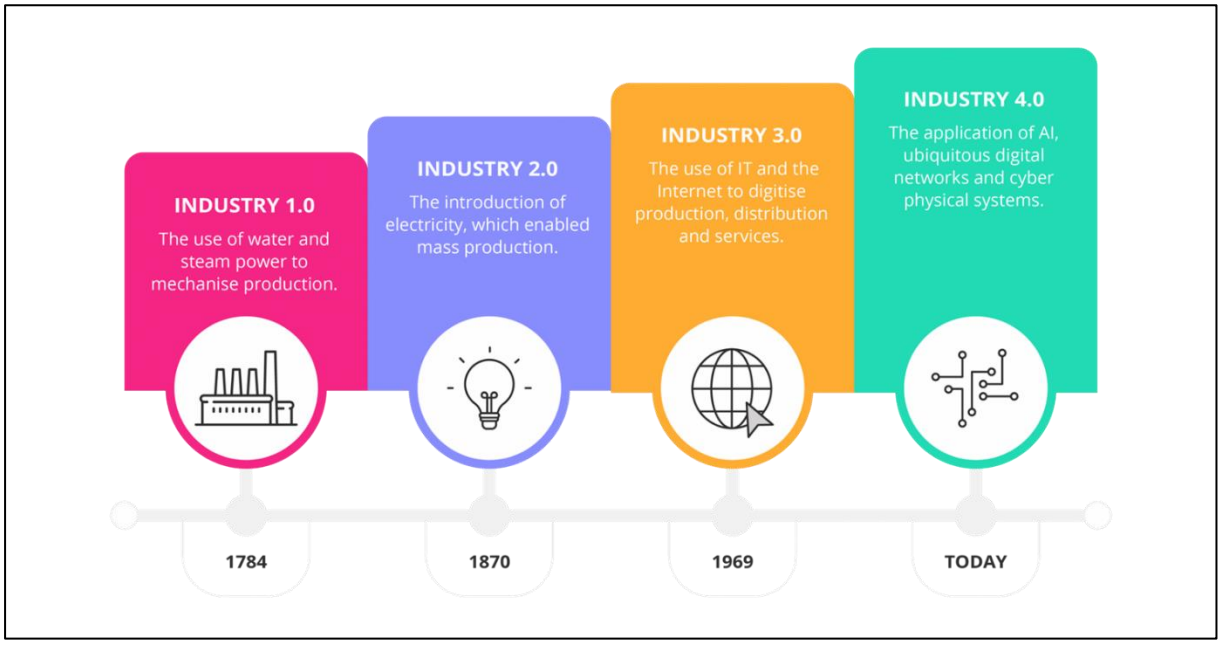
employees will be able to access via smartphone or tablet. Other innovations include the transition from paper-based recruitment processes to online and app-based applications. The Thusong Service Centres[2] will also be equipped with e-Service stations where residents can access and perform services themselves.

3. **Digitisation of Paper Processes** where paper recordings are digitised. The Department of Home Affairs embarked on an extensive process of scanning and collating 5.8-million paper-based records per annum. This is expected to improve security and turnaround time when retrieving records, enable e-Governance and allow for forward, accurate planning for education and other basic social services (Odendaal, 2016). National health information could also be digitised where a system integrates to secure, online, electronic patient records and other databases, such as for financial, pharmacy, laboratory and supply chain management data (Simons, 2018).
4. **Digitisation of the Classroom** where schools utilise technology in teaching and learning. This may be in the form of online learning, virtual lessons and "smart boards" and tablets in schools, harnessing ICT to improve education (Ngobeni, 2018).

It should be noted that much of the response around adopting "emerging" technologies has focused on ensuring the basics are in place, such as fast and reliable internet as well as digitisation, and the resultant processes they enable (smart cities and e-Services). To this effect, Schoonraad & Mthethwa argue that "any service that is not digitised would not be able to derive potential benefits from the 4IR…It is therefore critical to ensure that key aspects of the third Industrial Revolution, namely digitisation and (affordable) access to broadband connectivity are concluded" (2018). In this comment by the authors, the reader is reminded of the diagram below, first presented in section 4 which explains the industrial revolutions.

[2] A Thusong Service Centre is a one-stop service centre providing information and services to communities, through the development communication approach, in an integrated manner (Thusong Service Centre, n.d.)

Figure 4-1: History of Industrial Revolutions



Source: (GetSmarter, 2019)

It can be appreciated from the above diagram that digitisation is actually an aspect of the Third Industrial Revolution ("3IR") and online platforms on their own do not constitute "ET" (see **Figure 4-2** for examples of ET).

It appears, then, that the Public Services Sector is still trying to catch up with 3IR. However, Simons (2018) presents evidence that South Africa has not always been behind, "in 2001 SA was initially ranked first in Africa for e-Government. However, it has since either remained static or slipped lower in the global ranking. Tunisia and Mauritius are now regarded as the two highest-ranked countries in Africa, with South Africa, Egypt, Seychelles and Morocco following closely behind."

The Public Service Innovation Centre sees a holistic approach being adopted whereby not one single technology will accelerate innovation in government but rather a set of technologies working in tandem. It is further noted that 4IR will require a new I.T business model in order to realise 4IR capabilities (Public Service Innovation Centre, 2020).

> "The current model is centred around 3IR business models, especially at SITA, where we have an old way of doing and supporting I.T. When it comes to emerging technology, we need to adapt to the times, in order to be 4IR ready."
>
> Interview, (Public Service Innovation Centre, 2020)

We have also seen a global movement towards embracing e-Government through various models in which the Public Services Sector interacts with stakeholders. However, these models rely on digitising paper-processes in order to fully recognise the benefits that e-Government can unlock for the nation and its people.

The next section will highlight the need to move towards e-Governmental models in order to increase efficiency but also to direct cost-saving to areas that need it the most.

4.1. e-Government Models

ET and ICT have played an important role in fostering improved connectivity, as well as socio-economic development throughout the world by means of better communication, improved processing and exchange of information. This now impacts every aspect of our lives, constantly revolutionising the way we communicate with each other, comprehend our environments, and interact with government.

> "The Department of e-Government Gauteng sees cost-savings and efficiency in numbers using big data, cloud computing, A.I, cybersecurity and blockchain technology. The Department is also abreast on emerging technologies that are trending globally."
>
> Interview, (Gauteng Department of e-Government, 2020)

Since the development of the world wide web, considerable attention has been focused on the adaptation of web-based technologies to the business environment, notably in the Business-to-Business (B2B) and Business-to-Consumer (B2C) sectors. More recently, new sectors have been gaining attention, including those that involve government, such as Government-to-Business (G2B) and Government-to-Citizen (G2C). It is perhaps not surprising that governments (whether local, regional, national or even international) have been slower to adopt these technologies: governments are traditionally more conservative entities, slower to change, and slower to adopt new initiatives than Private Sector businesses (Davison, Wagner & Ma, 2005). There has been growing interest and movement towards e-Government, with National governments implementing technological transformation across their portfolios (Davison, Wagner & Ma, 2005).

Information Technology has become an indispensable factor not only in industry and service businesses, but also in governing systems at the micro (cities and regions) and macro (state and nations) levels. The information processes, which includes automation have, in the last few years, had an important impact on the transformation from “classical” governance into “smart governance” (Roblek et al, 2019).

The use of innovative approaches for being more agile, along with, the use of ET denotes a ‘smart’ or e-Government. In this way, a more robust governance and government infrastructure can be attained (Gil-Garcia et al, 2014).

e-Government and e-Governance were first developed in the United States of America, United Kingdom, Canada, and Australia, at the end of 20th century. The real potential of e-Government is being realised globally when it is placed in the context of overall government performance and governance (for example Abu Dhabi Government, Korea and Australia), rather than of a series of technology projects (Infodev, 2009).

e-Government has two significant roles:

i) The transaction role

Considers how governments use e-Government models to increase efficiency in delivering public services and how a government interacts with its citizens. This could be through submitting online applications, or renewing permits and drivers’ licenses (Roblek et al, 2019).

ii) e-Democracy

Considers how using ICT via an e-government channel, can increase and enable the citizen and public through e-participation in formulating, and supporting policies. This channel creates a direct link in participation in decision-making and formulation of public policies process. (Roblek et al, 2019).

e-Government should not be conflated with e-Democracy or e-Governance, as the latter considers how citizens interact with the political decision-making and implementation process, while the former is the provision of public e-services that may include an e-Democracy model.

The various stages of digital government is characterised by the transition from web presence towards the end of the spectrum - e-Democracy as explained in the following literature and table provided by Weerakkody (2015).The image shows how various

leaps, along with increasing benefits and costs, move over time/complexity and integration, which move a nation along the spectrum and through various phases i.e. a jump from the provision of web services to interaction services is made possible by technological developments; while moving from interaction phase to the transaction phase requires a cultural shift within the transforming institution. The ultimate transition to e-Democracy requires a political shift, which is the hardest to attain. More on this process can be read in Weerakkody (2015).

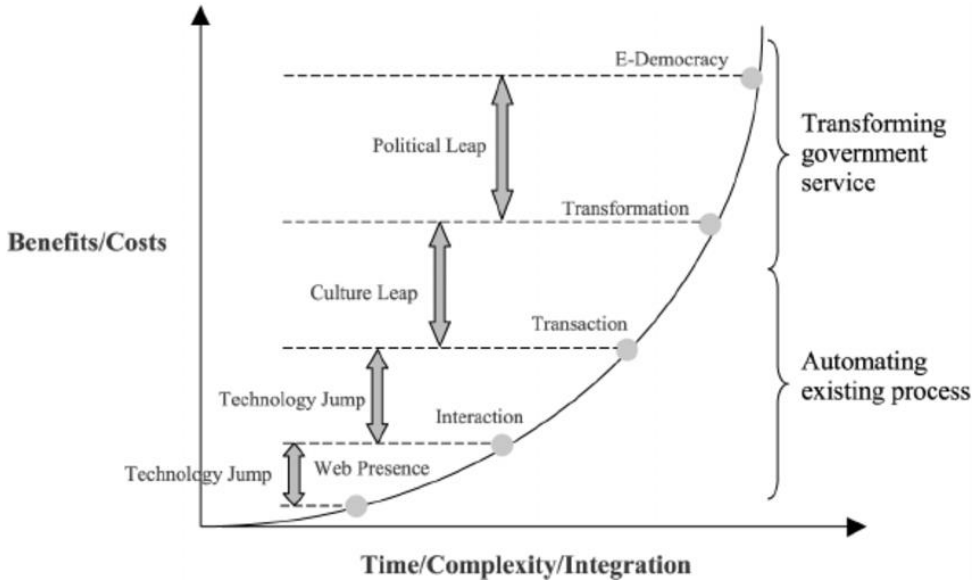
South Africa has a sporadic use of e-Government throughout the various Provinces and Departments. This would place South Africa, more generally weighted across all Provinces and Departments within Interaction and Transaction phases, with some outliers such as the Gauteng Department of e-Government and Public Services Innovations Centre at the transformation phases.

Figure 4-2: Digital Government Stage Models

<table>
<tr><th colspan="6">Example of some digital government stage models in literature</th></tr>
<tr><td>Gartner (2000)</td><td>Layne and Lee (2001)</td><td>Hiller and Belanger (2001)</td><td>UN (2002)</td><td>Siau and Long (2005)</td><td>Lashree and Marthandan (2010)</td></tr>
<tr><td rowspan="2">Presence</td><td rowspan="2">Cataloguing</td><td rowspan="2">Information</td><td>Emerging presence</td><td rowspan="2">Web presence</td><td rowspan="2">Web presence</td></tr>
<tr><td>Enhanced presence</td></tr>
<tr><td>Interaction</td><td rowspan="2">Transaction</td><td>Two way communication</td><td>Interactive presence</td><td>Interaction</td><td>Interaction</td></tr>
<tr><td>Transaction</td><td>Transaction</td><td>Transactional presence</td><td>Transaction</td><td>Transaction</td></tr>
<tr><td rowspan="2">Transformation</td><td>Vertical Integration</td><td rowspan="2">Integration</td><td rowspan="2">Seamless or fully integrated presence</td><td>Transformation</td><td>Transformation</td></tr>
<tr><td>Horizontal Integration</td><td>E-democracy</td><td>E-society</td></tr>
</table>

Source: (Weerakkody, 2015)

Figure 4-3: e-Government Framework



Source: (Siau & Long, 2005)

New and emergent technologies, over the last three decades, have continuously disrupted the administrative landscape of bureaucracies and the Public Services Sector around the world. The COVID-19 pandemic has also furthered the drive globally and locally towards using ICT and ET within the Public Services Sector. South African Departments are also recognising its impact on the 'new normal' along with its benefits from a business continuity perspective while reducing costs.

This is why, governments at different levels, and across different branches, are adopting tools and applications to reach out, to deliver, to function, and to organise themselves in ways that allow them to cope with rapid changes. The implementation of e-Government provides exponential benefits (e.g. convenience, efficiency, lower costs, collaboration and increased transparency) for its stakeholders (Roblek et al, 2019).

> "Emerging technologies will amongst other things allow the Public Services Sector to keep pace and stay relevant with younger generations by interacting in ways in which they expect to receive information. There will also be more collaboration within the sector, departments will be able to share, collaborate and to leverage off each other and improve on collective capabilities."
>
> Survey Respondent.

However, the path towards being a smart government comes with challenges, with disruptive forces posed by innovation and ET often testing the basic characteristics of public programs while identifying gaps in capabilities of how the enabling environment can attain and close these gaps (Gil-Garcia et al, 2014).

e-Government is understood as:

> *"a service, provided by the state, through the use of new tools, processes and consumer-level apps in interacting with citizens and businesses"* (Roblek et al, 2019)

Even with these ideals of what an e-Government has to offer, the Department of e-Government of Gauteng outlines that there is no real incentive to change. This is why, at the National level, incentives need to align with government prescripts in order to fully harness the power of ET. Gauteng's Premier had driven the e-Government agenda, while being at the right place at the right time due to policy driven support from the integrated ICT White Paper and the Broadband connectivity plan. This created the perfect opportunity for Gauteng's e-Government to be approved in parliament. Zooming into the Provincial level, a critical document is the Gauteng Growth and Development Strategy (Gauteng Department of e-Government, 2020).

The DPSA should be more aggressive in its drive towards digitising the Public Services Sector as the DPSA sets the pre-scripts, employment requirements, standards and agenda for ET adoption (Gauteng Department of e-Government, 2020).

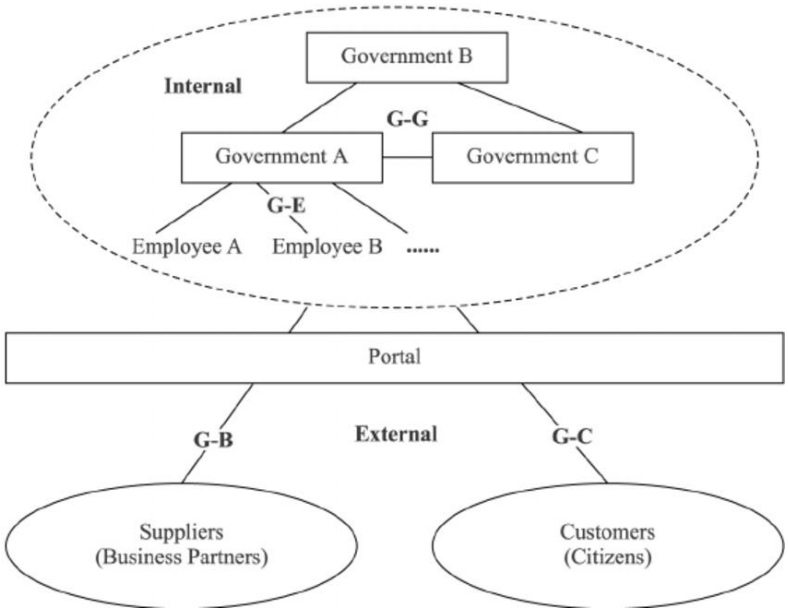
> "There are no real incentives for change – the DPSA sets the agenda."
> Interview, (Gauteng Department of e-Government, 2020)

e-Government is seen as a key enabler towards innovative technological solutions that decrease levels of bureaucracy, increase citizen trust in government activities and increase their possibilities for cooperating in governmental decision-making and public policies (Bolivar and Meijer, 2016; Sangki, 2018).

According to the existing research, the e-Government system can be divided into four phases, which are: cataloguing, transaction, vertical integration and horizontal integration; and four models, which are: G2G (Government-to-Government) model which sometimes includes a subset of Intra-government (IEE) model and the G2E

(Government-to-Employee) model; the G2B (Government-to-Business) model, and the G2C (Government-to-Citizen) model.

Figure 4-4: e-Government Models

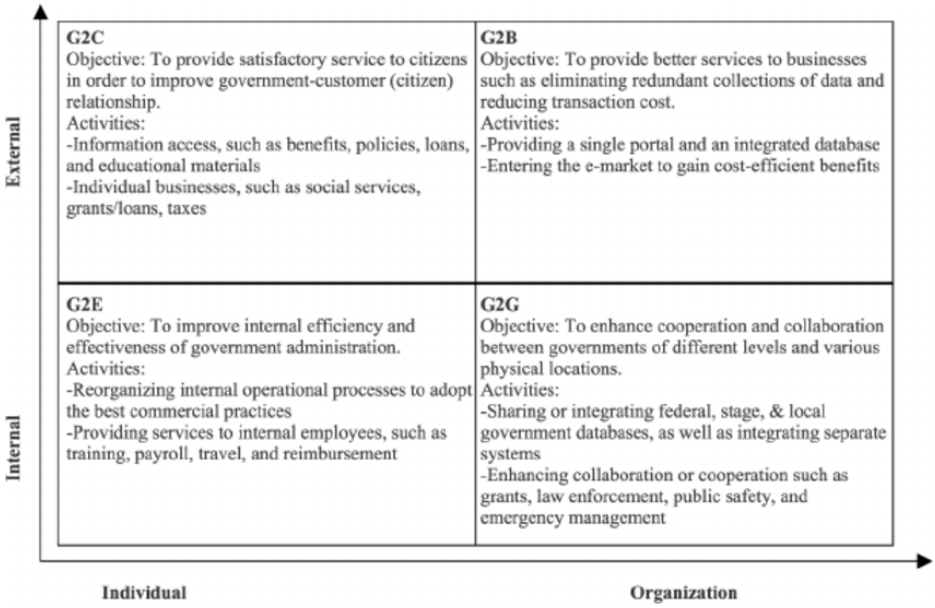


Source: (Siau & Long, 2005)

These are derived from B2B and B2C models that had previously emerged in the Private Sector, with the main actor being the government standing as a key role player in these G2(X) interactions. Where X denotes the relationship type between the government and its stakeholder channels.

A summary table of e-Government portfolios can be seen below. This table provides a more depth outline on the nature of the interactions and coordination i.e. internal and external; the type of stakeholder i.e. individual or organisation and some examples of the G2(X) relationship channels of each model type.

Figure 4-5: e-Government Framework Table



Source: (Siau & Long, 2005)

4.1.1. Government-to-Government (G2G)

Relationships from Government-to-Government (G2G) refer to the relationships and channels between the different government bodies aimed at improving communication between them, achieving more efficient delivery, and avoiding redundancies and duplication between them.

G2G improves and builds-up cooperation and collaboration between government agencies. Communication between government agencies, i.e. exchange of data, depends on the collaboration and cooperation mechanisms that they put in place.

G2G systems generally come in one of two types: internal-facing which connects at a National level, Government departments, agencies, organisations, authorities, and external-facing systems that connect multiple National Government information systems.

An example of an internal-facing G2G system in South Africa would be the South African National Treasury – IFMS (Integrated Financial Management System) which is a transversal integrated financial management system to be used by all National and

Provincial Departments for Finance, HR, Supply Chain and Business Intelligence (Department of Communications, n.d.)

A well-known example of an external facing G2G models would be that of the Schengen Information System developed to meet the requirements of the Schengen Agreement (the movement of EU citizens between member nations) (European Commission, 2020).

Baležentis & Paražinskaitė (2013), outline that some authors position G2E as a subset of G2G or that it should be titled as IEE (Internal Efficiency and Effectiveness). Whereas, in other literature works this is seen as a separate model, which is part of four model types, including the main analysis of e-Government.

This section explains G2G and G2E as well as IEE, so that their models can be understood by looking at how these models connect government to various entities with no particular clustering of subsets.

Intra-government Internal Efficiency and Effectiveness (IEE)

Intra-government Internal Efficiency and Effectiveness (IEE) models' purpose is to improve the flow of information within the internal or National Government, to improve the efficiency of the supply chain by achieving significant cost savings, reducing inventory, achieving better prices when purchasing, as well as all the changes necessary to improve this efficiency.

An example of an IEE model is e-Procurement. This is done through the online government procurement portal which is one application that has been successfully implemented in several countries, with a range of benefits. These benefits include transparency, reducing businesses' transaction costs, and reducing opportunities for corruption (Infodev, 2009).

South Africa's National ICT procurement department for the National and Provincial governments is SITA. SITA's centralisation role is towards National alignment and cost savings as the National procurement department.

4.1.2. Government-to-Employee (G2E)

Relationships between the Government and its employees (G2E) are aimed at improving interaction between the different government bodies and their employees,

with the intention of generating higher productivity when managing human resources, some examples can be seen in ***Table 4-1: Applications of G2E*** (Dawes, 2008).

Table 4-1: Applications of G2E

Example	Description
E-payroll	Aids in maintaining the online sources to view pay checks, pay stubs, pay bills, and keep records for tax information.
E-benefits	Provides the ability to look up what benefits an employee is receiving and what benefits they have a right to.
E-training	Allows for new and current employees to regularly maintain the training they have through the development of new technology and to allow new employees to train and learn over new materials in one convenient location or virtually
Maintaining records of personal information	Allows the system to keep all records in one easy location to update with every single bit of information that is relevant to a personal file. Examples being social security numbers, tax information, current address, and other information

These activities are online interactions through instantaneous communication tools between government units and their employees with the purpose of offering employees the possibility of accessing information in regard to compensation and benefit policies, training and learning opportunities and civil rights. It also allows an effective way to provide e-learning to the employees, and to promote knowledge sharing among them.

> "Open e-Learning courses i.e. MOOC's (massive open online courses) along with 9 online courses, are provided to Public Services Sector employees as long as they have a .gov email address, they can do these courses for free and print certificate. The NSG is currently further developing its e-Learning courses".

4.1.3. Government-to-Business (G2B)

Government-to-business (G2B) models are activity and relationship channels by the Government with business. G2B initiatives have been playing the important role in building a comprehensive and responsive e-Government environment in a "one-stop, non-stop and customer-centric" way, thereby enabling the promotion of business-to-business (B2B) initiatives to facilitate business firms improving their efficiency, effectiveness and reliability, thus becoming more sustainable and globally competitive, with some examples seen in ***Table 4-2: Applications of G2B*** (Kwok, 2014).

Table 4-2: Applications of G2B

Examples	
• Social contribution to employees	• Submission of data to the statistical office
• Corporate tax	• Customs declaration
• VAT	• Social contribution to employees
• Registration of a new company	• Environment-related permits

This is where Government provides multiple social services through a network. Enterprises can apply for these services directly, through an e-Government portal which offers e-services such as business registration, procurement, as well as key information logging for government statistics (Dong & Songtao Han, 2010).

4.1.4. Government-to-Citizen (G2C)

The Government-to-Citizen(G2C) model looks at the relationships and channels between the Government and its citizens or customers, placing the emphasis on the ability of the government and the public to pass information between the parties in an efficient electronic manner.

G2C e-services relate to the way in which citizens can directly be empowered to interact effectively with the government at the Local, Regional or National level. This is where citizens can directly interact with government services through electronic platforms with some applications of G2C being seen in ***Table 4-3: Applications of G2C***.

Table 4-3: Applications of G2C

Examples	
• Income taxes	• Birth and marriage certificates
• Car registration	• Enrolment in higher education
• Application for building permits, licenses	• Announcement re: moving house
• Declaration to the police	• Health-related services
• Public libraries	

Examples of South African initiatives around G2C include: e-Filing of tax returns introduced by SARS; The Department of Home Affairs migration of offline National Identity Documents to online using a smart card identification system; Online payment systems to facilitate payment of traffic fines adopted by all metropolitan municipalities; and the e-Natis online vehicle and transport management system introduced by the Department of Transport (Department of Communications, n.d.).

The Department of e-Government Gauteng is re-imagining service delivery for the public. The Department does not directly interact with citizens through their e-Government touch points but rather through the Gauteng Provincial Government (GPG) departments, whom the Department of e-Gov provides facilitation services around trending ET solutions.

> "Gauteng's success story is that as a province, all e-services can be accessed from one portal facilitated by the Department of e-Government".
>
> Interview, (Gauteng Department of e-Government, 2020)

An example of this is where citizens will interact directly with the Department of Health e-portal, that was enabled by the Department of e-Gov who provides the departmental projects' requirements, budget and projects' pipeline.

The next section will look at some of the research findings from the consultations and electronic surveys and its impact on Government services.

4.2. 4IR Impact on Government Services

This section explains research findings as it relates to the findings from the consultations and survey relating to the impacts of ET on the Public Services Sector.

South Africa is in dire need to digitise paper processes, as the majority of Public Services Sector work remains paper-heavy. The move to paperless was more of a buzz word with its true meaning only resonating now, especially due to COVID-19 amplifying the need to move away from human contact and touch-points.

> "You would be surprised by the way we use paper, from physical forms and attendance registers to evaluation and manual capturing of results".
>
> Interview. (National School of Government, 2020)

Some Departments such as DHET and DIRCO, by their very nature will require a process realignment by doing an ET gap analysis to see if digitisation is possible given their bureaucratic and legal systems.

> "By design - the Department is highly administrative and paper intensive for example submissions on a daily basis of memos and circulars; it's a lot of paper-based work."
>
> Interview. (Department of Higher Education and Training, 2020)

The NSG provided an example of the need to protect against COVID-19; the current process is still reliant on paper files, where each page is sprayed and sanitised. This is clearly an onerous and manual process. This is why the NSG sees digitisation for electronic document replacement being a major need in the Public Services Sector.

> "We have a paper-pushing current process, some forms are completed in triplicate still! The simple things are not digital".
>
> Interview, (National School of Government, 2020)

This will not only lower risks presented by COVID-19 but also lead to time-saving, cost efficiencies and auditability in documentation processes.

This is happening across Departments and Provinces, another example presented by the Eastern Cape Office of the Premier, highlights the overburdened use of paper processes hampering the use of ET.

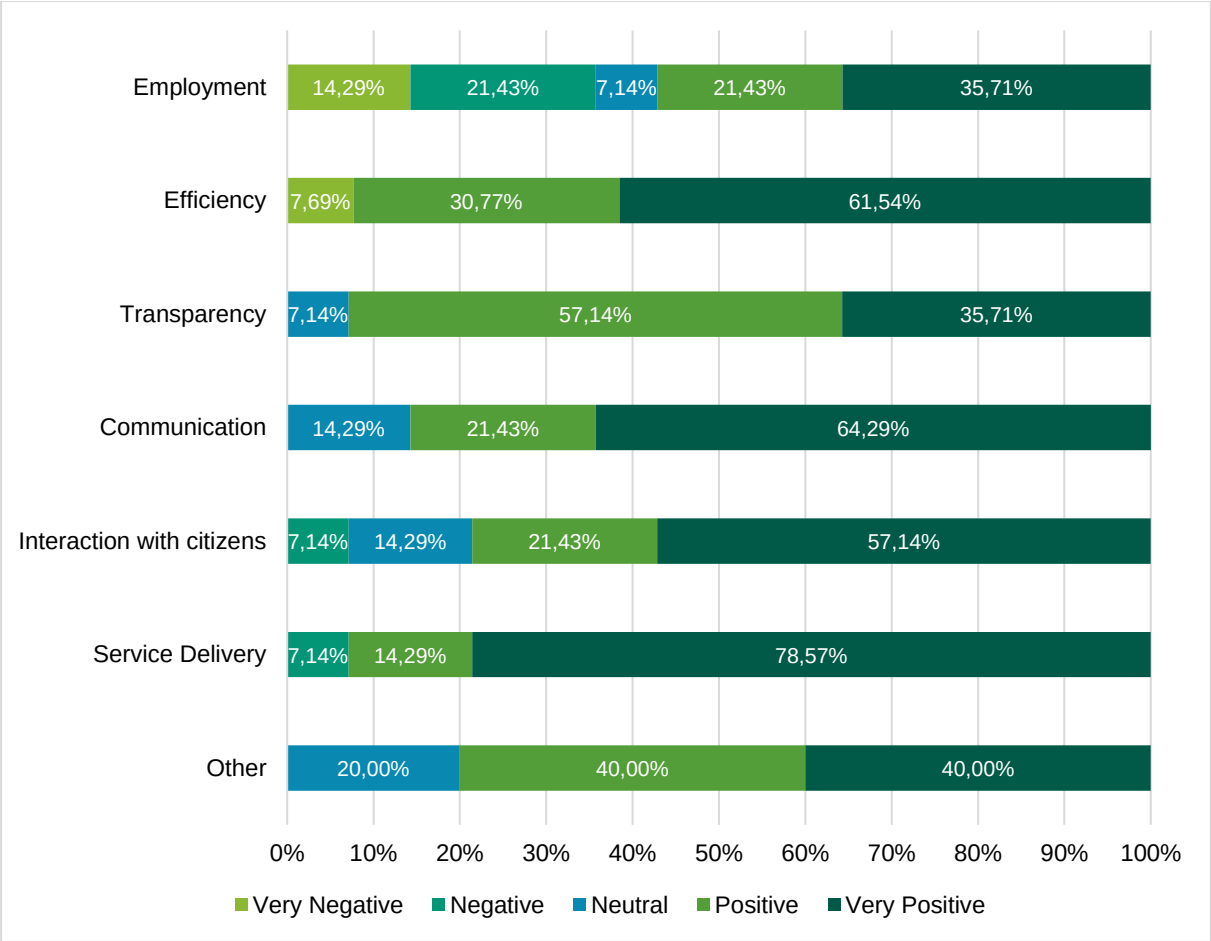
> "We walk around with physical manual submissions, scared of COVID19 through touching paper, therefore, moving towards digitisation [not automation] of online submissions, would be beneficial.
>
> Interview, (Eastern Cape Office of the Premier, 2020)

In terms of the impact that ET will have on the Public Services Sector, in general, the results from National and Provincial department respondents answered the following in terms of their views on ET on the Public Services Sector. This is the aggregated view across the respondents in the Public Services Sector, shedding some light on views towards ET and the sector:

What type of impact does the [Public Services Sector] think ET will have on the following in the Public Services Sector?

The majority of respondents see a positive impact on service delivery, efficiency, communication and transparency. Slightly more respondents (57%) had positive views on its impact on employment in the sector.

Survey Finding 4-1: Impact of ET on Public Services Sector



Source: PSETA, Emerging Technologies, Survey, 2020

From the consultations, it was evident that many were more open to the use of technology due to COVID-19 amplifying technology use and its benefits. Many see that technology may increase productivity and that skills development is a key factor in this regard.

> "The current model of service delivery is expensive. The use of emerging technology will enhance the service delivery provision".
>
> Survey Respondent.

ET will improve service delivery, productivity and institutional communication and the respondents feel positive about the potential of ET impact on the public services ability to do their work.

> “Emerging technologies will enable doing more with less and hopefully, more efficiently and of better quality.”
>
> Survey Respondent.

There were also concerns around the urban- rural divide, in that ET will benefit urban societies more than in rural communities.

> “Impact in my view is mostly negative, as it does not cover people in the rural areas. They will not access the services equally as people in urban areas.”
>
> Survey Respondent.

5. Impact on Skills

This section highlights the impact ET have had on the Public Services Sector. The sub-sections explore the various effects that the COVID-19 pandemic has had on the Public Services Sector, ET and learning, the skills shortage context, the current and future skills needed to embrace ET, and the feedback from various Departments and Provinces through the research findings. This section considers the various skills and traits needed with some literature pointing out how innovation can be boosted in the Public Services Sector. During this section, the research findings are discussed in detail from the consultations, that includes both qualitative and quantitative feedback. Recommendations and thematic trends are, thereafter, presented in Section **0** : *Key Findings and Recommendations.*

5.1. Emerging Technologies and Learning

Much of the government's effort to adopt ET has focussed on transitioning from old paper-based and manual processes to the digitised solutions of an e-Government. "[W]e need to consider whether our governments are investing in the modernisation of the state in order to position it for competitive performance and productivity within the eminent 4th Industrial Revolution" (Pilane-Majake, 2018).

The Centre for Public Service Innovation (CPSI), an agency of the DPSA, is at the centre of understanding 4IR in the Public Services Sector. Former CEO of the CPSI, Thuli Radebe, notes that in order to respond appropriately to ET the following questions need to be answered first (Radebe, 2018):

1. What are the implications in terms of skills that are required for this future Public Services Sector?
2. Are academic programmes (i.e. curricula) taking us where we want and where we have to be?
3. Are we already outdated in terms of qualifications, skills and competencies?
4. Are we familiar with the new way of thinking – the so-called skills and competencies of the future as expressed in words, phrases and common understanding of robotics, design thinking, new business models development, artificial intelligence, innovation, creativity, awareness of the

world we live in, experiential learning, continual learning, ideation, nano-technology, etc.?

All four questions above urgently speak to skills development and point to the relevance of PSETA and the role it has to play in 4IR. In understanding and appropriately responding to skills needs, the SETA needs to consult critically with the sector, including the key stakeholders mentioned in section 3.2.3.

CPSI has been involved in a number of projects that seek to revolutionise the Public Services Sector and improve service delivery. Two of these projects are described below as examples of work being done in the Public Services Sector (Rohaidi, 2018):

1. **Pharmacy Dispensing Units (PDUs):** CPSI partnered with the NPO Right to Care to scale up ATM-like machines that dispense medication to patients. These PDUs have improved efficiency and stock control, reducing losses. In addition, waiting times for medication in hospitals have been reduced from 4 hours to 45 minutes. These PDUs may be considered examples of Automation and Robotics. There are currently PDUs in four shopping malls and several hospital pharmacies.
2. **Panic Buttons:** The CPSI has been working with the South African Police Service (SAPS) to develop and install alarm systems in informal settlements. Previously it used to take police 48 hours to respond to incidents as they would often struggle to locate incident areas due to the poor spatial planning of informal settlements. However, equipped with GPS, the panic buttons installed in residents' homes guide the police to the correct location. CPSI's Pierre Schoonraad explains that, the response time has now been reduced to seven minutes and one community saw a 9% reduction in crime (Public Service Innovation Centre, 2020). The Department of Basic Education has expressed interest in such a system to safeguard school ICT equipment.

These examples point to an impact on both public servants, where technology makes their jobs easier, and the general public, where technology speeds up processes to their convenience and safety.

Whilst at least two problems may have been solved by ET, at least one problem is presented by them: how do you tax cryptocurrencies[3] such as bitcoin? Schoonraad & Mthethwa (2018) present this question that may be of interest to government institutions such as the South African Revenue Service (SARS) and the National Treasury, “Digital currencies, (unregulated, global) now have a market capitalisation of more than $270 billion. Being encrypted, and defying National boundaries, it is nearly impossible to tax in the traditional manner. If the current exponential growth trajectory continues, some banking systems and tax regimes may become redundant”.

One such solution is surfacing whereby crypto asset exchanges need to comply with the Financial Action Task Force requirements around identifying who sends cryptocurrency to whom (FATF, 2020). This is the start of a regulatory crack-down on cryptocurrencies. SARS has also developed rules around the taxation of cryptocurrencies (SARS, 2018). How does government use similar technologies used in cryptocurrencies i.e. Blockchain, to strengthen governance, transparency and automation?

4IR will create new jobs, change existing jobs and displace some jobs. Schoonraad & Mthethwa (2018) explain that the “role of machines is no longer confined to repetitive, dangerous or manual tasks. Machines can now do many high-level tasks such as financial modelling and market analysis.” This insight proposes that 4IR will also be active in administrative and governance duties and will not be confined to “technical” jobs in sectors such as manufacturing, engineering and ICT. However, reducing reliance on Private Sector consultants, the Public Services Sector will also require their own “technical” experts such as Software Developers and Data Analysts (Schoonraad & Mthethwa, 2018). This emphasises the importance of a flexible and cognisant skills development strategy.

In addition to upskilling in technical skills, 4IR will also have an impact on soft skills. Important soft skills in the Public Services Sector include customer service and leadership skills. Tengeni (2018) argues that 4IR demands ethical leaders who “when faced with instances where decisions have to be made between competing demands, and against waning resources” will prove their leadership capabilities. In a time of uncertainty and new terrain with potentially unexplored and unintended consequences,

[3] A cryptocurrency is a digital or virtual currency that is secured by cryptography and is based on blockchain technology (Investopedia, 2019)

the author further proposes that performance management needs to be improved in government to bolster accountability, “there is a dire need in the Public Services Sector to strengthen performance management, particularly at the level of Directors General and Heads of Department. This should span the entire chain from strategic plans, annual performance plans, and performance agreements” (Tengeni, 2018). To the effect of developing government leaders, the National School of Government (NSG) is a key stakeholder in skills development. The school has various programmes in administration, management and leadership with the aim of ensuring “public servants are able to access relevant knowledge and develop critical, reflective, analytical and problem-solving skills that will enable them to be responsive to the needs and demands that confront the Public Services Sector” (National School of Government, 2018).

The next section will consider the backdrop of the previous skills shortage exacerbating the gap in the use of ET within the Public Services Sector as well as its implications.

5.2. Skills Shortage Context

Often South Africa is mentioned in the media as:

> *“Not having the skills for the jobs of tomorrow”* (Business Tech, 2019)*;*
>
> *“Skills shortages threaten South Africa’s 4IR progress”* (Engineering News, 2020) *and;*
>
> “Fear, resistance and skills shortages threaten SA’s 4IR progress” (IT Web, 2019).

This is not only true for the Private Sector, but in general, including the Public Services Sector, specifically, when it comes to utilising ET within public service delivery, e-services and e-Government.

Looking at Media, Information and Communication Technology Sector Education and Training Authority (MICTSETA) Sector Skills Plan (SSP) that outlines occupations with hard to fill vacancies in the sub-sector for the ICT industry. The table below provides the top 15 hard to fill vacancies across the MICT Sector by relative demand and contribution to 4IR. The primary indicator for a Hard to fill vacancy is the quantity needed, which is then ranked against other occupations in an index according to its relative contribution to 4IR and relative demand, both of which are based on survey input, as outlined in the MICTSETA SSP (2019).

Table 5-1: In Demand Skills from MICTSETA SSP

Occupations Code	Scarce Skills: Occupations Table	Quantity Needed
2019-251201	Software Developer	2434
2019-351301	Computer Network Technician	1948
2019-216603	Multimedia Designer	824
2019-251203	Developer Programmer	823
2019-252301	Computer Network and Systems Engineer	731
2019-252901	ICT Security Specialist	713
2019-251101	ICT Systems Analyst	676
2019-251202	Programmer Analyst	397
2019-242101	Management Consultant (Business Analyst)	359
2019-311401	Electronic Engineering Technician	276
2019-243101	Advertising Specialist	224
2019-215303	Telecommunications Network Engineer	164
2019-2521	Database Designers and Administrator	114
2019-214401	Mechanical Engineer	22
2019-215101	Electrical Design Engineer	19

Source: (MICTSETA SSP, 2019)

Furthermore, MICTSETA mainly points to the lack of experienced candidates being the main reason for the shortage. This also relates to the emergence of cloud computing, big data and organisations moving into open source platforms. The stakeholders from the MCITSETA SSP are reporting a need for the IT professionals to remain knowledgeable, often with new technologies rendering some practitioners obsolete. Although there might be some supply of general skills, there is often a need for practitioners to have experience and background in mobile applications as this is an emerging area (MICTSETA, 2019).

This is not only a leading indicator for the Private Sector, but it also draws attention to technology skill trends that will be required by the Public Services Sector alike. The

Public Services Sector generally lags in regards to the Private Sector when it comes to ET. In this way, forward planning can be taken into account, even with this shortage being experience nationally.

MICTSETA (2019), SSP extract further explains that:

> *"Software developer, programmer analyst and developer programmer are some of the top 10 occupations which are hard to fill within the sub-sector. The top programming languages were found to be .NET, C#, C++, Java and VB. On the other hand, there has been a decline in demand for people to maintain legacy systems (such as COBOL developers). In addition, many companies were adopting the agile project management methodology. As a result, "Scrum Masters" were in demand, though there are very few people in the country that have certified qualifications to work with the method. With regard to telecommunications which incorporates both the retail side and the technical side, Network specific professionals, such as computer network technician and computer network and systems engineer, continued to be in demand."*

In addition, the MICTSETA SSP (2017) outlines that Enterprise Content Managers are in demand by all government departments and is a high scarcity occupation. In addition to the scarcity reflected above:

> *"The Government Information Officers Council (GITOC), representing all government departments CIOs in South Africa has identified scarcity of suitably qualified people from a government IT's viewpoint as follows* (MICTSETA SSP, 2017)"

Table 5-2: Skills Scarcity from Government IT Perspective

Government Information Officers Council (GITOC) Critical Skills	
Business Analyst	Developers (Web & Portal, Business Intelligence, SAP ABAP, Open Source, Mobile Apps)
Consultants (SAP HCM, SAP SRM, SAP Authorization, SAP Basis)	Network Administrators
Architects (Data, Application IT Managers	Quality Assurance Administrators

Source: (MICTSETA SSP, 2017)

Keeping the skills shortage in mind, the development of a ubiquitous grass-roots strategy to drive the ET agenda needs to be an enabler. This is where developing

digital and STEM (science, technology, engineering and math) skills are critical to unlock opportunities.

This is why identifying digital skills development goals for the various educational levels is so important, coupled with the SETAs spearheading ET training. ITU (2018), defines areas in which nations need to develop and implement digital developmental goals that create the enabling environment for the Public Services Sector in:

- primary education;
- secondary education;
- tertiary education: for students, and digital technology development & design experts;
- work-related digital skills training programmes for out-of-school youth, including for freelancers and part-time workers;
- work-related digital skills training programmes for adults requiring re-skilling;
- skills for life in the digital economy for all citizens.

Furthermore, a recent article in the Mail & Guardian (2020) mentions that, South Africa has one of the youngest populations in the world; and that more than 60% of Sub-Saharan Africa's population is under the age of 25.

Therefore, this is why it is essential that adequate investments in education at all levels are made to equip the new generation of Africans joining the workforce with the right skills. This is especially valid, given South Africa's digital skills gap that needs to be developed, more so when the Public Services Sector services make up a majority of South Africa's employment rate.

Therefore, we need to develop the skills for the future through effective leadership, change management, or capacity building, key competencies and an innovation-mindset in the Public Services Sector.

This speaks to developing the future skills through basic digital literacy and training.

5.3. Developing Future Skills

The use of digital skills is present in most day-to-day activities and in every aspect of work and life. This can be seen directly from social media to communicating for work, with many careers or tasks requiring basic digital skills and functioning. This is where

we need lifelong opportunities to learn new skills that will allow us to succeed in an era of ongoing digital transformation (ITU, 2018).

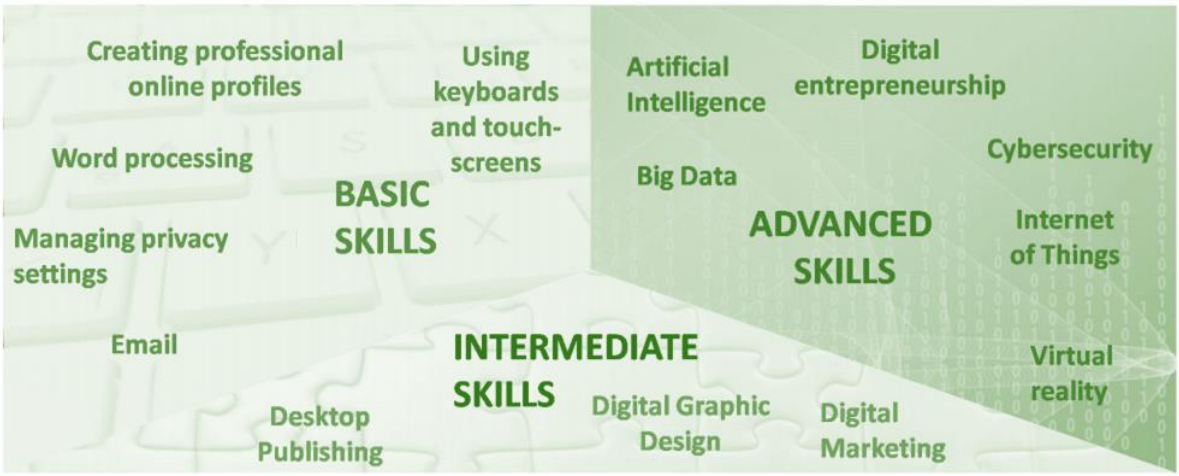
> "Digital skills exist on a spectrum, from basic to more advanced, and encompass a "combination of behaviours, expertise, know-how, work habits, character traits, dispositions and critical understandings.
>
> (ITU, 2018)

Nations that implement comprehensive digital skills strategies in aiding their populations with future opportunities rely on digital skills. This will allow citizens to be more employable, productive, creative, and successful. Due to the changing nature of ET, digital skills strategies need to be updated regularly to respond to the rapid pace of new technologies and their impact on digital society and the digital economy with many applications being applicable within the Public Services Sector (ITU, 2018).

> "Strong basic skills like project management, change management and electronic engineering will pave the way for 4IR. We saw this when telco's (MTN's and Vodacom's) entered South Africa in the 90's, we did not have the telco skills yet sound and adaptive fundamental skills and systems of transitioning"
>
> Interview, (Public Service Innovation Centre, 2020)

Therefore, developing digital skills is a matter of providing the opportunity while amplifying the types of skills that are needed for the task, specifically when it comes to basic, intermediate and advanced skills. These skills have been outlined in the below image by ITU (2018) continuum of digital skills.

Figure 5-1: Continuum of Digital Skills



Source: ITU (2018)

ITU (2018), outlines in their *Report on Digital Tools*, an array of various challenges when developing each of these future skills on the continuum, and how to bridge these gaps. The report further explains how institutions can create opportunities for under-represented populations.

The Department of e-Government has inclusive workshops and initiatives around growing and upskilling the provinces talent pool. A notable initiative is *Digital Sisters*, an initiative around empowering women in I.T and inclusive GPG intern training certified programs in Microsoft Azure.

> "There is a digital divide happening, and we [the Department], will leave no one behind".
> Interview, Department of e-Government Gauteng, 2020

One such way is through the use of SETA's. SETA's aid the identification and capacitation of skill gaps and development through information insights. Specifically, when ET is involved, the Public and Private Sectors are increasingly operating in an ever-changing environment where new trends are emerging all the time. Workers in the sector have to constantly upgrade their skills to keep abreast of the latest developments. At the same time as people skilled in technologies move on or retire, there is still a need for maintenance of these old technologies. That means gaps exist for old technologies where new entrants lack such skills, as well as, for all the new technologies being rapidly introduced.

MICTSETA, along with PSETA require stronger partnerships when it comes to identifying and developing these capabilities.

> "Sister SETA's need to collaborate more extensively to mobilise resources and gain a holistic insight". [Furthermore], "It's not about reinventing the wheel but strengthening what we have and building-on'.
> Interview, (Gauteng Department of e-Government, 2020)

The Department of e-Government Gauteng is collaborating with MICTSETA in upskilling across two key groups of personnel that the Department has identified as developmental areas:

i) Internally: the GPG department officials across the 14 departments which include the department of e-Government

ii) Externally: new recruitments that are external, to capacitate new young people towards I.T skills

Therefore, the SETAs play a key role in both the internal and external capacitation streams.

The NSG outlines that using technology requires moving towards digitally developing accreditations in crediting facilitators, moderators and assessor towards using virtual facilitation environments. Therefore, the SETAs need to develop this capacity which is a critical element in moving towards a digital focused strategy.

> "SETA's need to acknowledge the virtual facilitation process through crediting facilitators, moderators and assessors.
>
> Interview, (National School of Government, 2020)

Furthermore, the following are broad categories of critical skills gaps that exist amongst employees working across the public and Private Sectors, and for which employers have to implement various skills development.

Interventions to address:

- Management and leadership skills
- Customer service skills
- Technical skills
- Production efficiency skills

Furthermore, a failure to address the capacitation of the Public Services Sector can exacerbate the digital divide between and within the Public Services Sector and Private Sector. This is, therefore, a top priority when it comes to inclusive growth, remaining relevant and impacting every employee.

The digital divide is any uneven distribution in the access to, use of, or impact of Information and Communication Technologies (ICT) between any number of distinct groups based on social, geographical, or geopolitical criteria, or otherwise. This is created and exacerbated by the high cost of ICT adoption, with its utilisation being uneven across the globe. This can happen across countries as well as within a nation's borders.

The digital divide requires key enablers needed in order to support e-Government. This is centred around internet concentration and ubiquity (the Enablement Environment section **6**) and ingraining a digital native citizen through the educational grassroots while promoting an innovations mindset.

Thus, moving towards the use of ET in providing e-Government, e-services and ultimately towards an e-Democracy is a way to bridge the digital divide, where continuous Government-to-Citizen (G2C) interaction is facilitated in order to become a more interactive democracy, through the e-Government models (Section **4.1**) (Sangki, 2018).

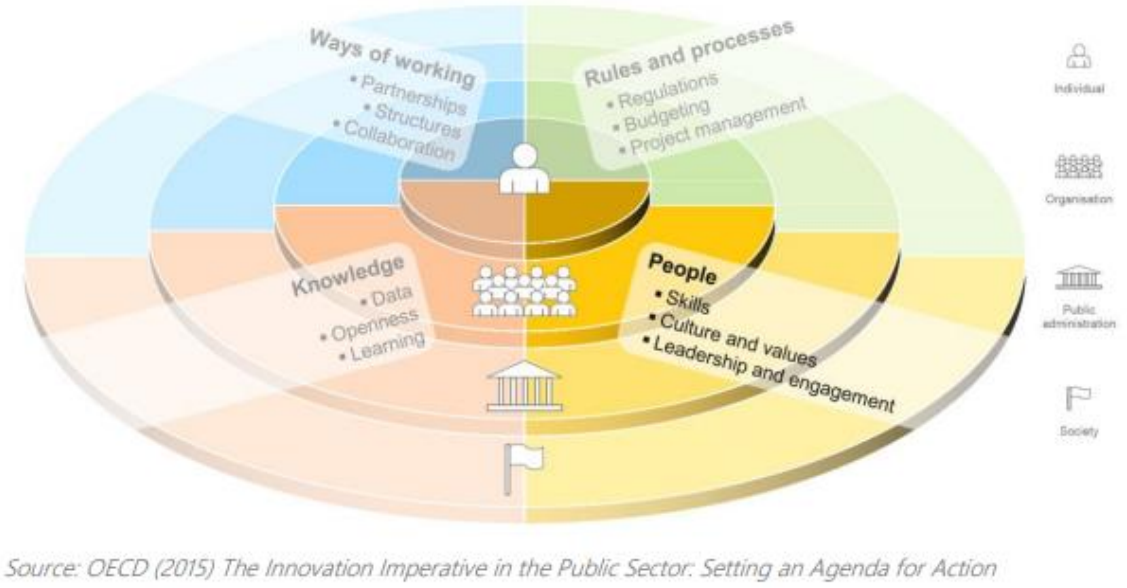
Specifically, when it comes to innovating in the Public Services Sector, the OECD (2017) outlines four calls to actions, explained in Table 7.

Table 5-3: Calls to Action for Public Services Sector

Focus	Innovating the Public Services Sector
Focus on people:	Governments must invest in the capacity and capabilities of civil society as the catalysts of innovation. This includes building the culture, incentives and norms to facilitate new ways of working.
Put knowledge to use:	Governments must facilitate the free flow of information, data and knowledge across the Public Services Sector and use it to respond creatively to new challenges and opportunities.
Working together:	Governments must advance new organisational structures and leverage partnerships to enhance approaches and tools, share risk and harness available information and resources for innovation.
Rethink the rules	Government must ensure that internal rules and processes are balanced in their capacity to mitigate risks, while protecting resources and enabling innovation.

Furthermore, the OECD (2017), outlines the innovative imperative model, that aids setting an agenda of action, focusing on: ways of working, rules and processes, knowledge and people capacitation, all with the mindset towards effective innovation within the Public Services Sector seen in Figure 8.2

Figure 5-2: OECD Innovative Imperative Model



Source: (OECD, 2017)

Further development of Public Services Sectors skills can be enhanced and accelerated through key Public-Private Partnerships (PPPs).

The Department of e-Government mentioned key drivers in building a future talent pool that is relevant and current in public service delivery. In order to attain this, the Provincial department has collaborated with partners such as IBM, Microsoft and SAP. A further work in process is the Gauteng Centre of Excellence, aligning with the Provinces view of becoming a smart province.

> "We need to embrace emerging technologies, collaborate with ICT players so that the correct skills will be available."
>
> Survey Respondent

Part of the process is the improvements in internet bandwidth, penetration and connectivity. There are educational partnerships with the University of the Witwatersrand through their partnerships in the Tshimologong Innovation Precinct. This is where the Department brings in young trained developers that are instrumental in skills development and the supply of talent to the Province and Department (Gauteng Department of e-Government, 2020).

> "Skilling and areas of focus look at championing on skills in the ICT sector skills and public-private partnerships being a key enabler; This is part of the Vision 2030 to be a smart city and Province."
>
> Interview, (Gauteng Department of e-Government, 2020)

In this way, capacity building and knowledge transfer occurs while remaining up-to-date with global trends. PPP can also be mutually beneficial, in that both the Public Services Sector improves its skills, while the Private Sector resources the development of the talent pool while providing services and ET to better aid public services.

The Department of e-Government Gauteng believes a more transversal approach to skills development is needed with mandated modules in ICT, done with the assistance of PPP (Gauteng Department of e-Government, 2020). This will allow the government to be better capacitated and move with the times across all departments. Furthermore, strong partnerships with the Private Sector allow new ways of working and new methodologies to be imparted, especially around design thinking, and agile project management. These not only complement innovation but enable better collaborative and productive work environments.

Looking at an international example, i.e. Singaporean Public Services Sector study by Accenture (2017), outlines key results around embracing new models and Private Sector talent to harness ET capabilities.

Figure 5-3: Singapore Embracing New Models

Source: (Accenture, 2017)

Thus, the development of future skills is reliant on the grass-roots foundations that citizens are exposed to, having institutions aid and close skills gaps through capacitation, resource planning and strategy; while forging National agendas and PPP with the Private Sector to foster the upskilling and reskilling of Public Services Sector

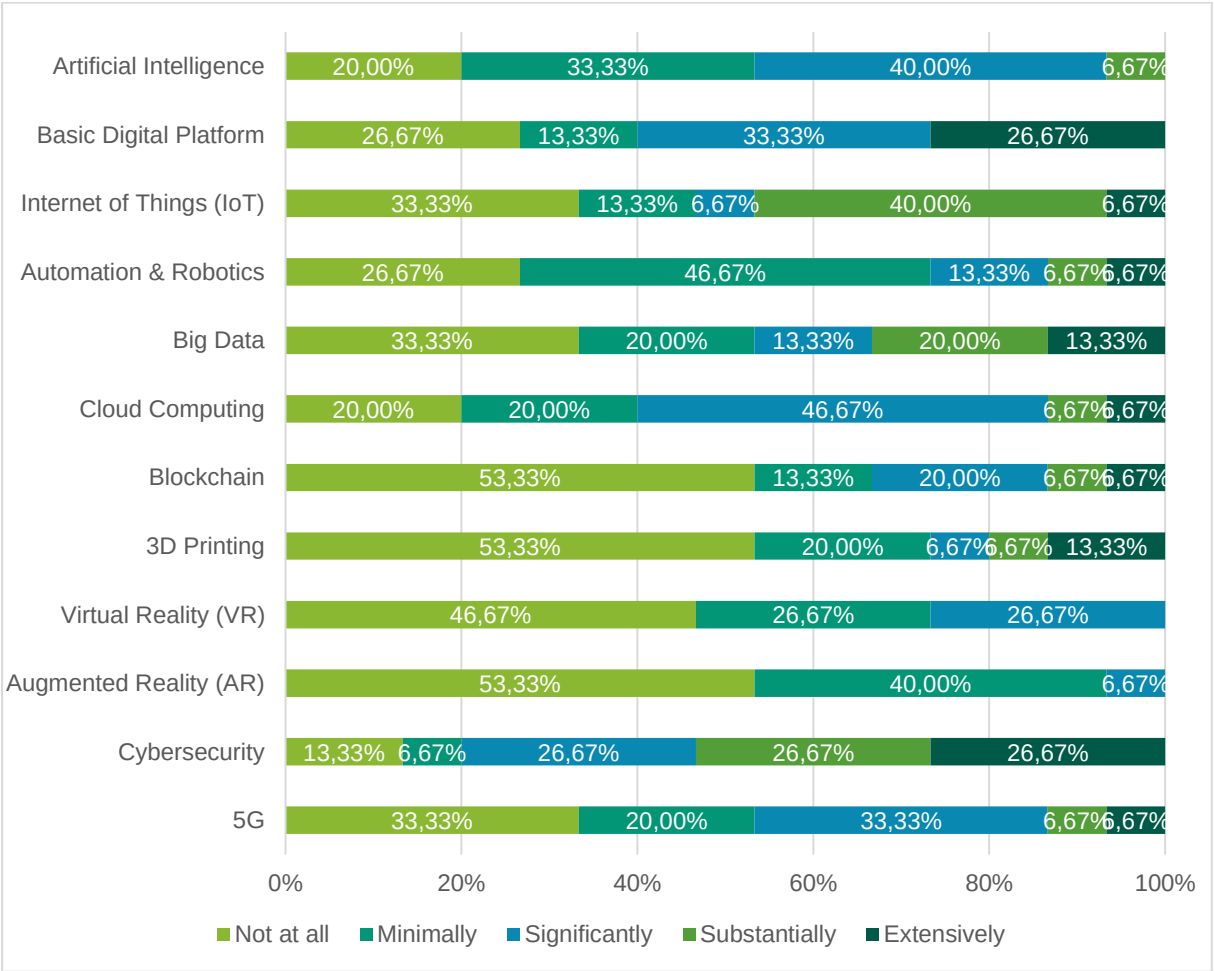
employees in order to adapt to augment their skills, tools and institutional culture. A further key enabler of innovation in the Public Services Sector is also entrepreneurship, where internal innovation entrepreneurs drive Public Services Sector innovation.

In terms of developing future skills, National and Provincial departments, answered the following in terms of the use of ET within their Departments. This is the aggregated view across the respondents in the Public Services Sector, shedding some light on skills gaps and trends in the sector:

To what extent does your organisation use the following ET?

Cybersecurity and Basic Digital Platforms were the most extensively used. This was then followed by a substantial use of IoT and Big Data. The significant use of 5G, Cloud Computing and AI. The majority of the ET listed that are not used at all: Blockchain, 3D printing, AR and VR.

Survey Finding 5-1: Use of ET



Source: PSETA, Emerging Technologies, Survey, 2020

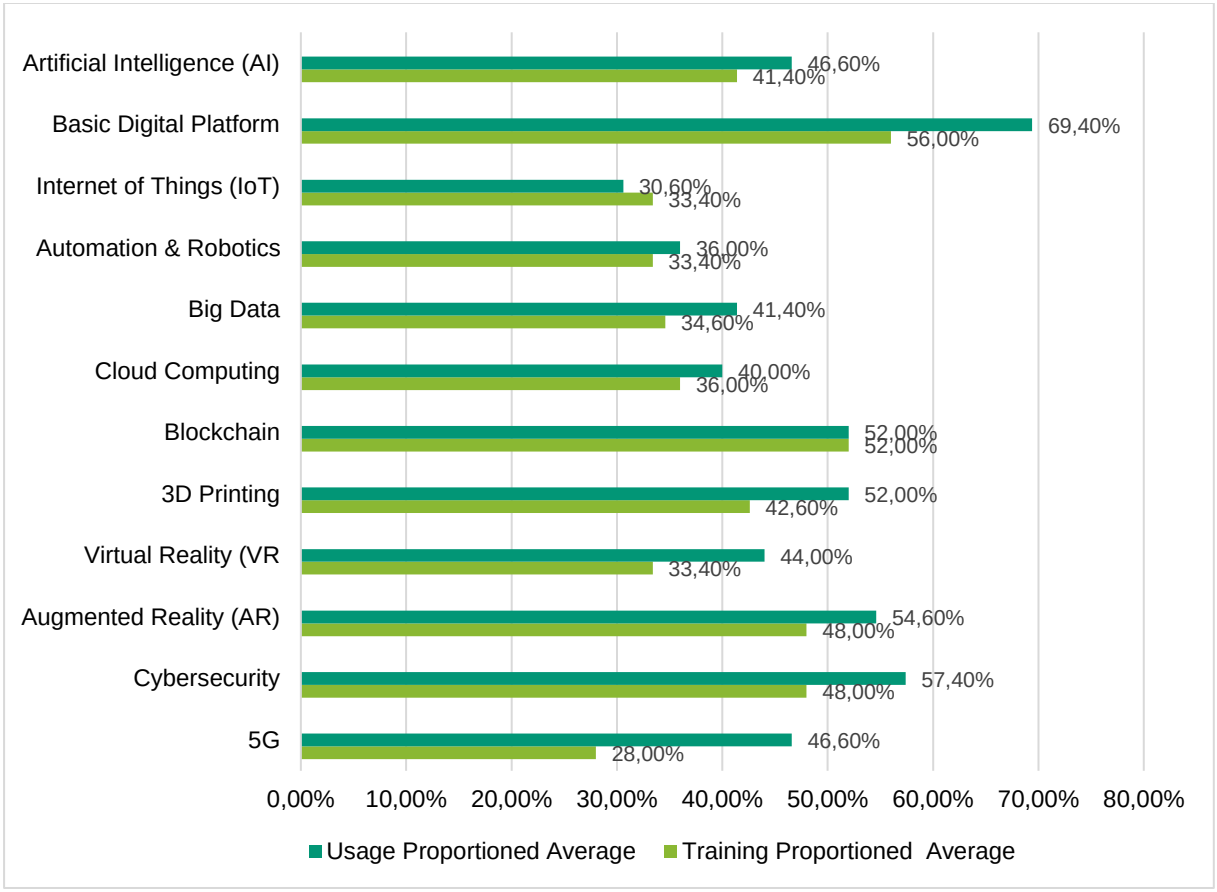
From the consultations, it was evident that the majority of these ET were not in use. The trend emerging for the discussion pointed to more use around Cloud Computing, Basic Digital Platforms and Big Data being mentioned often.

To what extent do employees use ET and are trained in using the above-mentioned ET?

The below graph shows the overlaps in skills demanded and those that are trained in the abovementioned ET. This outlines the skill development gaps that needed to be developed through upskilling and reskilling.

Respondent cited the top three most used ET are: Basic Digital Platforms, Cybersecurity and AI. Respondents mentioned that employees are trained in Basic Digital Platforms and Cybersecurity, however, there is a gap that can be further developed in the Basic Digital Platforms. The graphs below show a 13.4% gap between Basic Digital Platform usage and training. This outlines areas in which the SETA can provide further training or workshops.

Survey Finding 5-2: Use of ET Vs Employee ET Training



Source: PSETA, Emerging Technologies, Survey, 2020

From the consultations, it was evident that majority of Public Services Sector employees are not trained to use these ET or may not understand a particular ET. A case in point is Blockchain. Respondents mentioned that 52% use Blockchain while 52% are trained in Blockchain. From the consultations and other data, this is however, a contrary statement which outlines a lack of general understanding of ET.

The consolations highlighted an emerging trend towards the need of training focused on Cloud Computing and Cybersecurity, which further strengthen the survey findings.

5.3.1. Upskilling and Reskilling

As the types of skills needed in the labour market change rapidly, Public and Private Sector workers will have to engage in life-long learning if they are to remain not just employable but are to achieve fulfilling and rewarding careers that allow them to maximise their employment opportunities.

In order to contribute to socially responsible approaches to the future of work, it is critical for institutions to find the right talent through reskilling and upskilling strategies. This has wider implications for driving economic growth and enhancing societal resilience due to the rapid flux of ET change. This is where policy-makers need to prioritise reskilling and retraining the existing workforce in order to pave the way for future-ready education systems for the next generation of workers (WEF Inisght Report, 2018).

As public institutions move through the various e-Government, e-service and ET implementation maturity life-cycle, there is need to manage change effectively as some jobs will require either upskilling or reskilling due to the use of ET.

> “Strong fundamentals with anticipatory skills need to be supported by a continues learning environment within the current Public Services Sector environment.”
>
> Interview, (Public Service Innovation Centre, 2020)

Reskilling is defined as: “training for employees who have shown they have the aptitude for learning a completely new occupation.” For example, an office clerk whose job has become obsolete will need to learn new skills to perform a different in-demand job within the same organisation, such as a web developer (Eshelman, 2020).

While upskilling focuses on: “providing training for employees who need to learn new skills to improve their current performance without changing their position or career path.” One example would be a grants manager who uses Microsoft Excel to administer grants would need to be trained on robotic process automation as the organisation implements this new technology (Eshelman, 2020).

ET is transformative in a transversal way, in that it affects all touch-points, work methodologies, attitudes, the institutional culture and the nature of jobs and tasks.

Majority of the type of training needed in the Public Services Sector will be around upskilling, however, the pace of technological change may also require a focus on reskilling for jobs that do not exist 10-years from now. Hutt & Hallet (2016) of the World Economic Forum discuss in this article that from Uber drivers to millennial generation experts, a selection of some occupations that were not around in 2006:

Table 5-4: New Occupations that Didn’t exist 10-years ago

Occupations not around in 2006	
Social media manager	App developer
Driverless car engineer	Big data analyst/data scientist
Cloud computing specialist	Drone operators

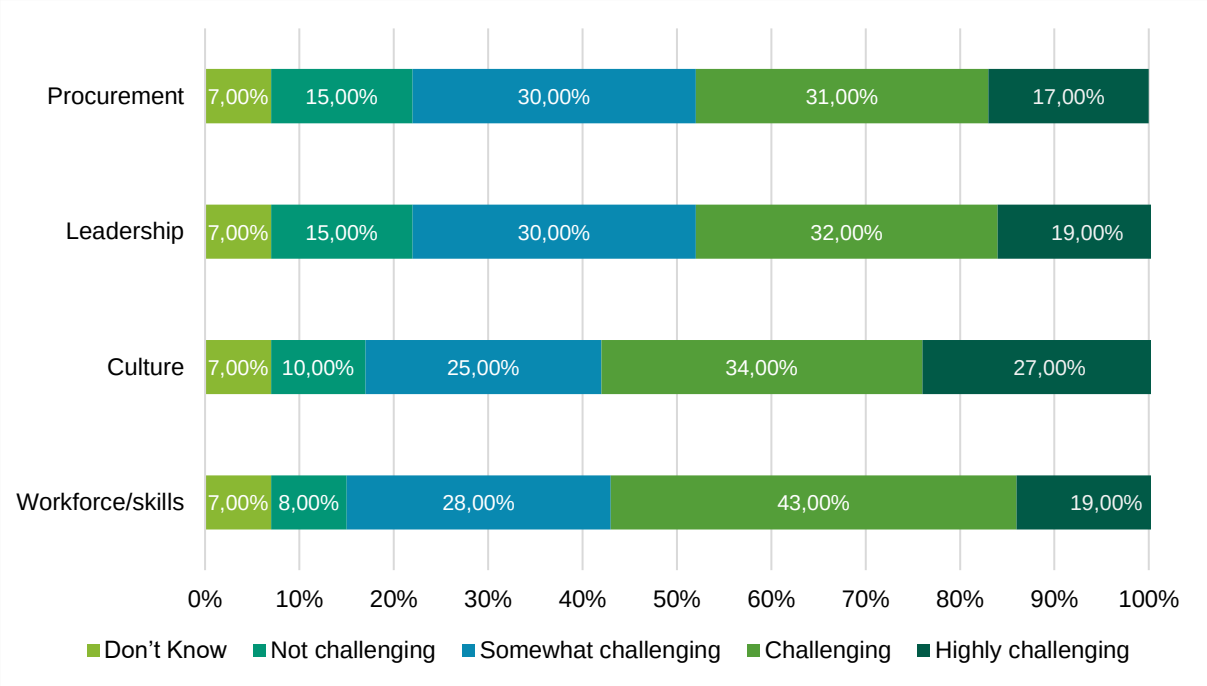
As a further example, due to the sheer volume of data created every day, we see business analysts, data scientists being in high-demand globally. This demonstrates how new jobs can be created due to the nature of new technological developments; therefore, training and skills capacitation will need to cater for the “*Jobs of Tomorrow*”.

> “Two-thirds of today’s five-year olds will, in about 15 years, find themselves in jobs that do not exist today. And the jobs that do exist won’t necessarily be located where the job seekers live”.
>
> (Deloitte, 2018)

Technology in its very essence is disruptive, which is also amplified in a world of constant change and shocks.

Deloitte (2015), found that in implementing digital transformation within public institutions the greatest challenges were related to people, that is: the workforce skills, the institutional culture, cultural dynamics and leadership.

Figure 5-4: Areas of Challenge



Source: (Deloitte University Press, 2015)

Change management will also aid the way in which new skills are phased into the Public Services Sector, whereby, older staff have the opportunity and resources to upskill and reskill through e-Learning platforms, apprenticeships and PPP.

The development of an effective change management plan is needed to mitigate these challenging areas, especially when it comes to ET implementation and training. This is where training delivered to management level Public Services Sector employees need to provide agility and leadership in driving change while removing obsess within their unique environment.

> "This is where the ability of senior management programs needs to provide the ability to identify trends, emerging issues and respond to them strategically".
>
> Interview, (Public Service Innovation Centre, 2020)

The office of the Premier KZN outlined that even though they have the big data capability, there are not many training interventions that the OTP critically requires. This is where underreporting issues occur. Also, not having the correct training makes it more difficult to backing claims by data insights provided by emerging tech tools (KZN Office of the Premier, 2020).

> "My view is that across the board there still a need for a lot of training to be done.".
> Survey Respondent.

Therefore, having the tools without having the capability can prove fruitless, and this is where management training and skills development become a key driver for sustaining and building capabilities.

5.3.2. e-Learning

The use and move towards e-Learning seem to have gained traction, with an uneven distribution and use of e-Learning being implemented across Provinces, at the Provincial level.

> "In terms of training delivery, we are still grappling – not everyone has access to laptops – we are investigating which departments have laptops, and to test the issue of connectivity, with remote areas being completely disconnected to virtual platforms".
> Interview. (Eastern Cape Office of the Premier, 2020)

Some Departments are still operating face-to-face facilitated learning and training programs and have had to cease programs due to COVID-19.

> "We do not have or use any of our own e-Learning platforms".
> Interview. (Department of International Relations and Cooperation, 2020)

At the National level, the National School of Government provides online self-paced courses which use an e-Learning platform in reaching public servant students across the country while freeing up resources in face-to-face instruction. Furthermore, the National Department uses chatbots, a form of A.I to assist in the informational load and free up human capacity.

ET through e-Learning platforms has allowed for a wider reach, with 24/7 capability and reducing transportation, classroom sizes and face-to-face instructor facilitation.

> "The Department is largely a face-to-face classroom type of learning environment, but due to the event of COVID-19, have resorted to accelerating the reach of our eLearning solutions".
> Interview. (National School of Government, 2020)

The NSG is mandated by legislation to provide training and learner support to all spheres of government including the legislative sector. The training is customised for various public employee levels (from Level 1 through to Senior Management) focusing on the various skills that public services need. There are, however, issues that limit the power of the NSG's Moodle LMS platform and other e-Learning platforms such as broadband, data costs and SITA site access restrictions. These infrastructural limitations, therefore, strain the reach that the NSG and other departments have in delivering high resolution training in virtual environments to public servants. The NSG accommodates this through low bandwidth and multimedia approaches. This limits content delivery such as the inability to do webinars, or open online classrooms. This is a department wide dilemma due to poor quality data lines.

> "Technological constraints limit the NSGs reach due to low bandwidth and SITA content restrictions".
> Interview. (National School of Government, 2020)

NSG is in the process of procuring a Private Sector line (i.e. a private provider of fibre cabling infrastructure) in which they tend to overcome some of these delivery issues.

The curriculum does not have an ET focus, this was a nation-wide element that surfaced with course mainly focusing on people management, leadership, and change management.

> "More technology-focused programs are needed with compulsory induction programs and re-orientation programs needed".
> Interview. (Mpumalanga Office of the Premier, 2020)

The way in which lecturers are to be capacitated and developed is also an issue that need to be resolved to eliminate points of failure when implementing ET or e-Learning platforms.

> "We are still working on our e-Learning strategy and the curriculum will follow-on. Our main challenge from the curriculum point of view is how do we capacitate lecturers better".
> Interview. (KZN Office of the Premier, 2020)

At the Provincial level, the Department of e-Government Gauteng is concluding a curriculum around cybersecurity education that is focusing more on the soft skills than on your hardcore technical persona (Gauteng Department of e-Government, 2020).

Furthermore, digital tools (laptops and 3G cards) are only provided to various seniority levels, with a limited reach in which digital tools are accessible across the Public Services Sector employee levels.

> "Only SMS and MMS management levels have access to digital tools. This makes remote working very difficult to implement across the lower operational levels".
>
> Interview. (National Treasury, 2020)

Even if training was provided via e-Learning, the general Public Services Sector employee would not be equipped to use method of instruction, as they are not equipped to work within a virtual and remote setting.

> "Staff are not equipped to work in a digital way".
>
> Interview. (Western Cape Office of the Premier, 2020)

Some public employees that are able to work remotely, utilise their own personal equipment or tools of the trade, in order to work remotely. This is only a privilege for a few whilst logistical issues are presented in: how does the specified department track and reimburse workers for use of their own resources?

> "Some of us are using our own equipment when working from home".
>
> Interview. (Department of International Relations and Cooperation, 2020)

Therefore, in e-Learning specifically, this is a wide spread issue that data costs, security aspects when working remotely as well as, access to laptops are limited in supply. The Public Services Sector still relies on employees working with desktops from their offices.

> "We are trying to ensure that the Department has the correct tools of trade to engage and participate in remote working and training. Half are on desktop and half are using laptops."
>
> Interview. (Department of Trade and Industry, 2020)

This also places a restriction on the ability to learn and access content through e-Learning Learning Management Systems (LMS) platforms and for organisation-employee communication when working or interacting in remote or virtual settings. Some communication is still done using bulk SMS with no internal virtual systems in operation in some Departments, and only a few using Microsoft Teams for virtual meetings.

> "During COVID-19, the Department still communicates by bulk SMS, email and telephone." Interview. (Department of International Relations and Cooperation, 2020)

Furthermore, as discussed with many Provincial and National government departments, there is also a rigid human resourcing structure. This structure determines what the staffing requirements are and the hiring of talent is done according to this structure. Therefore, we need to move towards more PPP certifications by Microsoft, SAP and IBM, which will allow for relevant and adaptable upskilling (Gauteng Department of e-Government, 2020). A further discussion mentioned strategy changes rather than a restructuring of the organisational structure, that needs to be approved by the DPSA, whom will approve budgets and the implementation of those requirements.

This cuts across all levels and salary levels. At the Department of e-Government Gauteng, training is done from Premier to administrative officer with the philosophy of not leaving anyone behind, an example of this is an A.I session open to everyone in the Department (Gauteng Department of e-Government, 2020).

The Department of e-Government Gauteng identifies the area of recognition of prior learning as having gaps, with the Quality Council for Trades & Occupations (QCTO) qualification system being ridged in upskilling towards international certifications via Microsoft and IBM, especially in a constantly changing technological environment. The educational system is slow to adapt curricular to the rapid diffusion of technology and new methods. Therefore, we need to reduce the red tape around qualifications and gradings to allow more technical skills to flourish and fill the skills shortage while, allowing a sustainable avenue for upskilling and reskilling workers.

This is an area of opportunity, as in general, older generations find the use of technology more challenging. Therefore, shorter certification avenues that are

recognised can close this gap, while the content remains relevant, timely and in line with industry demands.

This is referred to the technology generation affect is where older generations find it harder to grasp technology.

> "If you have an opportunity, the correct tools and the will to learn, you are never too old to learn new things. More than half of our enrolled Public Services Sector students are born in 1975".
>
> Interview. (National School of Government, 2020)

Combining an inclusive approach along with looks at ways in which technology adaption can be designed more inclusive ICT products and services for older users: taking into account the technology-generational effect (Lim Chong, 2009). For this reason, older public employees will require a tailored and self-paced upskilling plan to avoid facing a digital divide, while using e-Learning platforms for ubiquitous and timely delivery.

As for the *"Jobs of tomorrow",* public institutions need to think about how new and existing talent pool supply can be developed to meet future skills demand. This also fits into the institutional and political will of the institution in implementing change.

> "The demand for online education will increase, along with less paper and less physical meetings taking place. Working from home may become a standard."
>
> Survey Respondent

The *"Jobs of tomorrow"* also require new competencies along with a new profile or 'persona' of the Public Services Sector employee emerging. This new public employee persona will also need an innovation mindset trait that complements their competences in thinking, acting and delivering, an e-service, e-Government or e-Democracy facilitating ecosystem.

5.3.3. Competencies

The Public Services Sector *"Jobs of tomorrow"* require Public Services Sector employees to possess a new skill set of both hard and soft skills that re-tool them for new tasks, work augmentation and new ways of working and thinking.

> “New ways of working, requires new ways of thinking”.
>
> Interview. (Gauteng Department of e-Government, 2020)

We need to focus on ways to remove fear of technology use, while promoting positive technology behaviour through incentives. Some Departments have an internal culture that promotes change, whilst others are less willing to innovate. As an example, the Department of Correctional Services is more open to innovation and new ideas whilst others are more rigid (Public Service Innovation Centre, 2020).

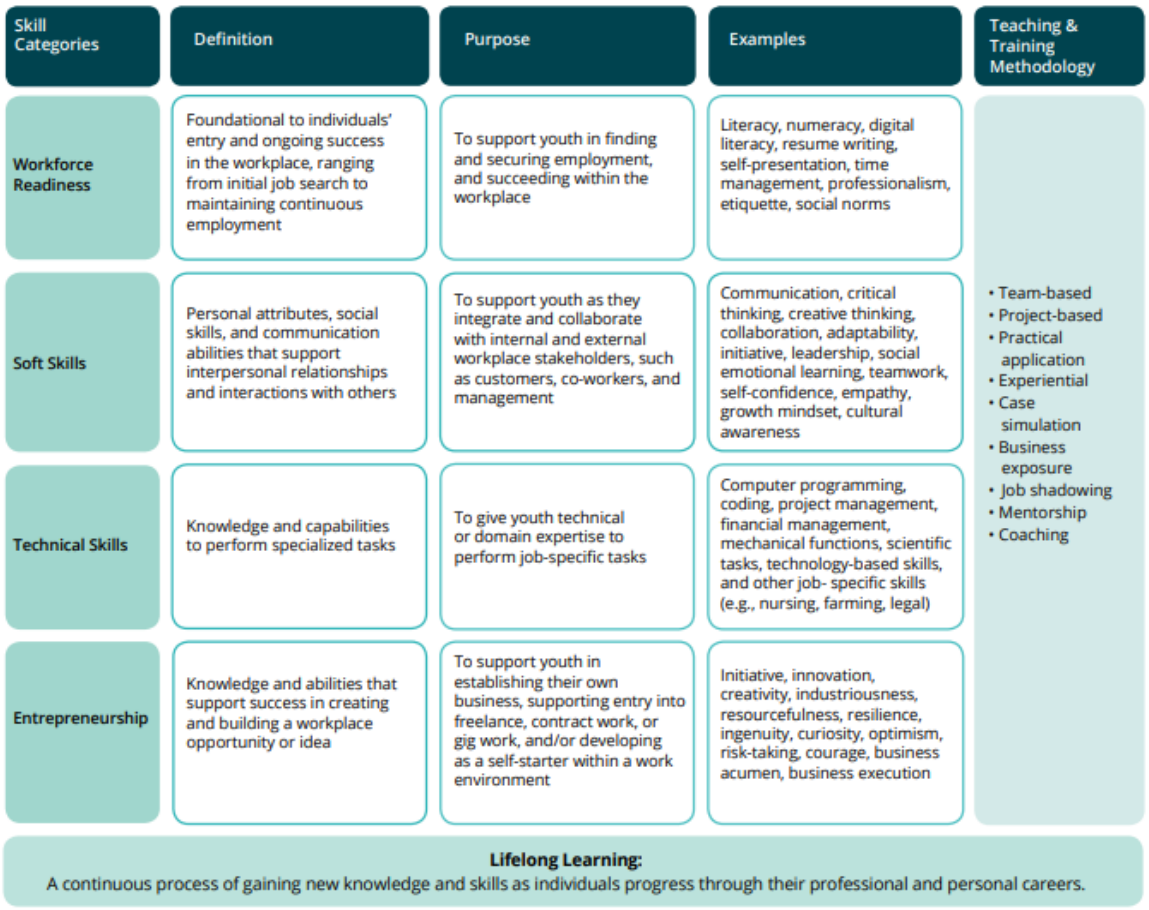
> “Public servants have a legitimate reason to fear change, and resist that change. They are comfortable with the current ways and do not trust the infrastructure. In this way, we need to manage fear around the use of emerging technologies”.
>
> Interview. (Public Service Innovation Centre, 2020)

This is why developing skills along with promoting the correct innovation traits is key to the innovations ecosystem and innovating within the Public Services Sector.

> “We need to develop and socialise emerging technology users in understanding brevity in meetings and technology etiquette”.
>
> Interview. (KZN Office of the Premier, 2020)

Other 21st century skills as mentioned by Deloitte (2018), that all public employees will require, are related to workforce readiness, soft skills, technical skills and entrepreneurship in a wrapper of lifelong learning and new teaching and training methodologies while harnessing the power of ET in their day-to-day activities.

Figure 5-5: Skills for 21st Century



Source: (Deloitte, 2018)

Across National and Provincial departments, an emerging theme being the main barrier to ET use, was related to people management and change.

> "Digital innovation is still very slow in the Public Services Sector and there is a need for leadership change, behavioural change and concerted effort from the strategic point of view to embrace technology in a holistic way."
>
> Survey Respondent.

Change is always understated; it needs to be managed effectively or it will derail the entire technology implementation and operational strategy. This is why instilling agility is a key trait for the new public servant, along with way to manage uncertain environments while innovating along the way.

> "Employees need to be better trained and capacitated to change their mindsets and adapt to organisational change in order to reduce change management issues".
>
> Interview, (Mpumalanga Office of the Premier, 2020)

Change through more effective curricular across institutional levels is critical, along with sound leadership in championing change.

> "It's important that we start with the change agents themselves with capacitation development".
> Interview, (Eastern Cape Office of the Premier, 2020)

Change agents are those that are responsible for implementing change. Change should not be rapid, but gradual, so that it is accepted as the new ways of working that shows benefits to the worker and the outcome.

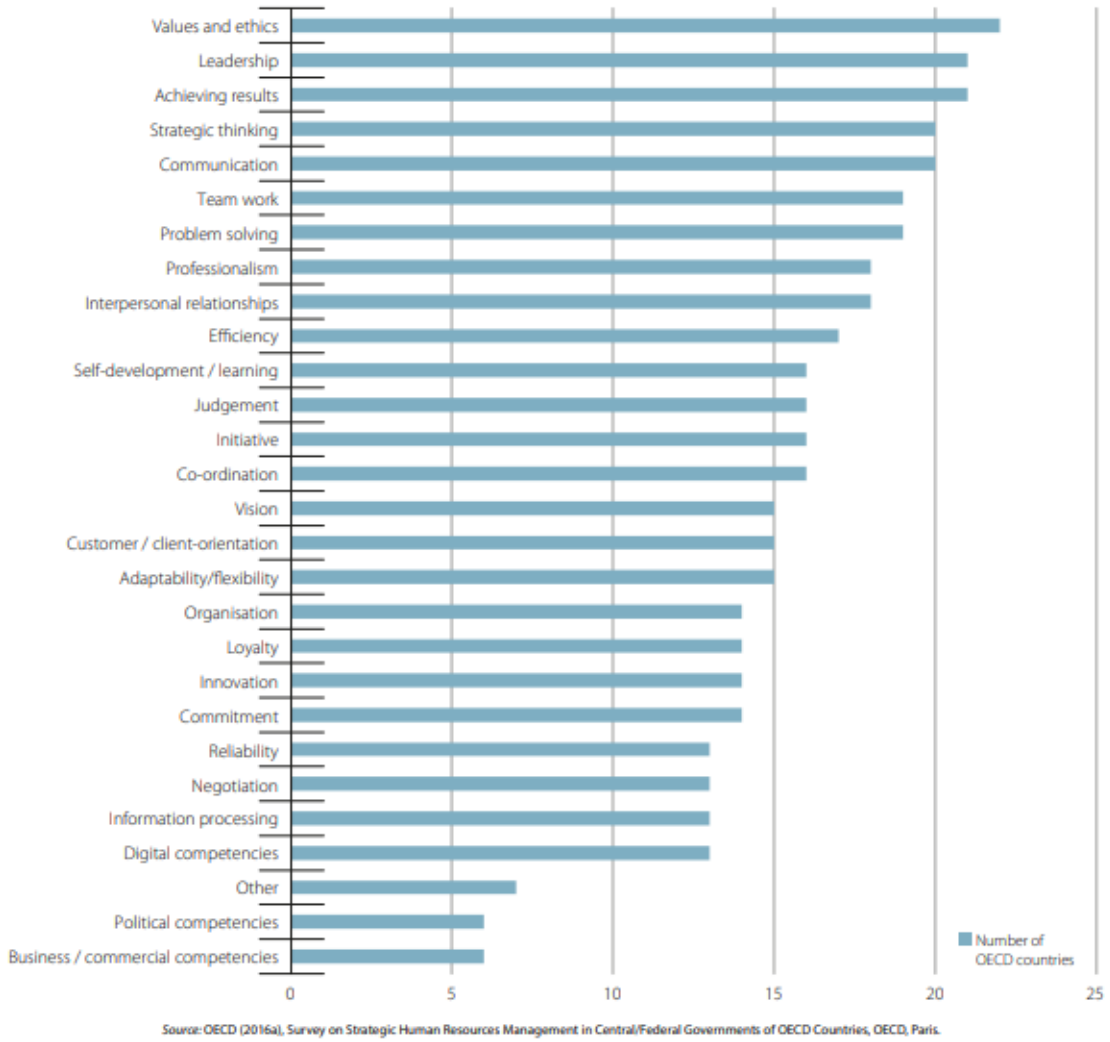
> "We are introducing new programs gradually - appointing interns to conduct department induction programs in a virtual setting. We need to get with the times."
> Interview. (Department of Trade and Industry, 2020)

The general ignorance of technology is a product of poor training, exposure to technology use and fear of the unknown. This is why change management that is inclusive across levels is more effective in stemming change inertia. Change also exposes gaps that need to be developed, in order to create a sustainable longer-term implementation.

> "There is an organisational culture inertia and a generally-wide ignorance of technology, we need to change this status quo".
> Interview, (Department of Public Enterprise, 2020)

The *OECD Public Governance Review Report on Skills for A High Performing Civil Service* (2016) , outlines competencies required for a high performing civil service:

Figure 5-6: Competencies



Source: (OECD Public Governance Reviews, 2016)

While developing skills, promoting competencies and traits that will initiate innovation and the use of ET within the Public Services Sector; this is but one component of the larger transition towards a digital government. Change agents should not neglect the importance of how the 'persona', or average public servant profile will change and need to be changed in order to create a sustained acceleration in the adoption of an innovations driven public institution.

5.3.4. New Public Services Sector Employee Persona Profile and Traits

Alongside specific skills that enable Public Services Sector innovation, research by the OECD *Skills for Public Services Sector Report* (2017), has identified that mind-set, attitudes and behaviours can be just as important as specific hard or soft skills in

enabling innovation within the Public Services Sector. Beyond the focus of individual skills and capabilities many research participants and stakeholders have highlighted a number of other organisational factors that are also crucial for increasing levels of innovation in the Public Services Sector. In particular, leadership capability, organisational culture and institutional functions/systems (finance, HR, IT, legal) that are enablers of innovation not 'blockers'.

> "We need to transform HR systems, job evaluation and job descriptions that reflect and are cognizant of where we want to be as a Public Services Sector regarding innovation".
>
> Interview. (Public Service Innovation Centre, 2020)

While outside the scope of the skills model, these are important factors that need to be considered in operationalising/ implementing the skills model and achieving higher levels of innovation in the Public Services Sector.

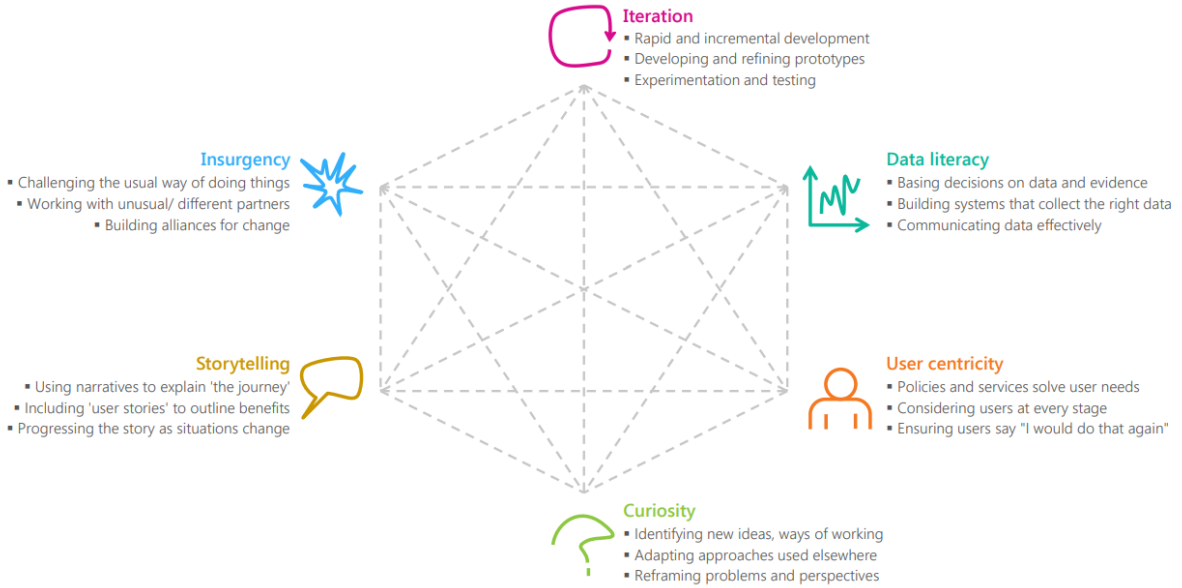
> "There will be a new look and feel when it comes to the new age public servant – the current profile needs to indeed change and adapt".
>
> Interview. (Gauteng Department of e-Government, 2020)

Not all public servants will need to make use of or apply these skills in their day-to-day job. However, for a modern 21st-century public service, all officials should have at least some level of awareness these six areas, as highlighted by the OECD (2017), in order to support increased levels of innovation in the Public Services Sector.

Table 5-5: Six Areas of Awareness

Skill	Description
Iteration:	incrementally and experimentally developing policies, products and services
Data literacy:	ensuring decisions are data-driven and that data is not an afterthought
User centricity:	public services should be focussed on solving and servicing user needs
Curiosity:	seeking out and trying new ideas or ways of working
Storytelling:	explaining change in a way that builds support
Insurgency:	challenging the status quo and working with unusual partners

Figure 5-7: Six Awareness Areas



Source: (OECD, 2017)

Since 2018/2019 the Department of e-Government Gauteng, has been on a path to build and amplify the correct skills sets. This was done through a skills audit, to highlight the grey areas and to see where the high-risk areas for current and future staff will be. Skills audits aid in identifying these areas and create the ability to see how departments can build the right talent pool for today, and the future.

> "The profile and 'persona' of the typical public servant has already started to change; we are experiencing this with the new interns coming in."
>
> Interview, (Gauteng Department of e-Government, 2020)

Therefore, the use of ET in the Public Services Sector involves complementary competencies, skills and traits to become an innovative Public Services Sector when using ET. This leads to the below framework which can help guide the development of these principles, considering the characteristics of the civil servants, the systems that manages them, and their leaders (OECD Public Governance Reviews, 2016).

Table 5-6: Towards a professional, Strategic and Innovative Civil Service

	Professional	Strategic	Innovative
Needs civil servants who are:	• Qualified • Independent • Values driven • Ethical	• Outcomes driven • Evidence based • Future oriented • Proactive • Networked	• Iterative • Data literate • Citizen centred • Curious • Storytellers • Insurgent
In a civil service which is:	• Merit based • Capable of integrating soft skills, ethics, talent management (future potential vs. past performance) • Able to structure the right balance of generalist and specialist professions and career paths	• Agile • Attractive to skilled job seekers • Planned and managed to ensure the right skills and competencies are effectively allocated to areas of current and emerging need • Future oriented and responsive	• Open and collaborative cultures, leadership and management • Engaged • Autonomous (e.g. work design) • Mobile • Diverse • Learning oriented
Led by Senior Civil Servants who are:	• Trusted policy advisors and effective transactional managers	• Transformational leaders, change managers	• Collaborative leaders and adaptive managers

Source: (OECD, 2017)

Moreover, since there is a strive towards professional, strategic and innovating Public Services Sector employee capacitation, a new profiling tool for Senior Management and HR will be needed. When profiling the skills of a government persona, a new way in which human resources outlines their key requirements in recruitment should tie into the educational qualifications, experience, job specification, competencies and traits that align to working with ET and the institutions innovations outlook, with cultural-fit.

The Department of e-Government Gauteng believes that there will be a new look-and-feel of government with a change is mind-shifts, as more and more technology is embraced in day-to-day operations.

Table 5-7: Future Public Servant Profile and Persona

Profiling	Description
1. Profile Role:	All profiles are categorised by the role they have within the Public Services Sector.
2. Quote:	This quote has been pulled from the participant interview, often a key point made by the participant.

3. Key Duties:	These cover what the main duties and responsibilities were for the role.
4. Added value demonstrated in practice:	How the participants believed their skills support innovation in the Public Services Sector
5. Competencies:	Competencies described by the participants, which they believed supported innovation to occur in their practice.
6. Broader competency grouping:	Initial grouping of individual competencies (5) into common themes.
7. Abilities and Motivations:	Learned skills, techniques and expertise, as well as the motivations described by the participant.
8. Experiences and Inspirations:	Education, learning, life events and previous work experiences of the participant.

Source: (OECD, 2017)

A full practical model of the new profile and template in practice can be seen in the following literature: OECD *Core Skills for Public Services Sector Innovation* (OECD, 2017).

The next section will look at some of the research findings from the consultations and electronic surveys.

5.4. The case of Emerging Technologies on Skills

The overall sentiment in the interviews was that the majority of Provinces and Departments see ET as being in its infancy. Current skills look at basic office tools like Excel and email, with only a handful utilising specialised ET training or technologies in their day-to-day operations.

However, optimism is high as most interviewees believe that the use of technology is the future and it will change the way that the public services sector will interact operationally and with the public. The stress on developing digital skills is also tied to the trust public employees attach to working with technology.

> "It's not easy to trust the system especially when the content is sensitive and your e-signature gets into the wrong hands."
>
> Interview. DHET ,2020

There is a fear that using technology will place them at a disadvantage and negatively impact their performance appraisals. Technophobia exists, whereby public employees fear technology. The NSG believes that this is something that can be overcome, for all ages and public officials who have an opportunity and the ability to learn. More than half of NSG enrolled students are over the age of 45 years old.

> "No matter the age or background, all people have the ability to learn, they just need the opportunity." Interview. (National School of Government, 2020)

In terms the case for ET, the results from National and Provincial departments respondents, answered the following in terms of the use of ET within their Departments. This is the aggregated view across the respondents in the Public Services Sector, shedding some light on trends across employee levels and skills required in the sector:

For the following ET, indicate which employee level requires knowledge and skills in the below.

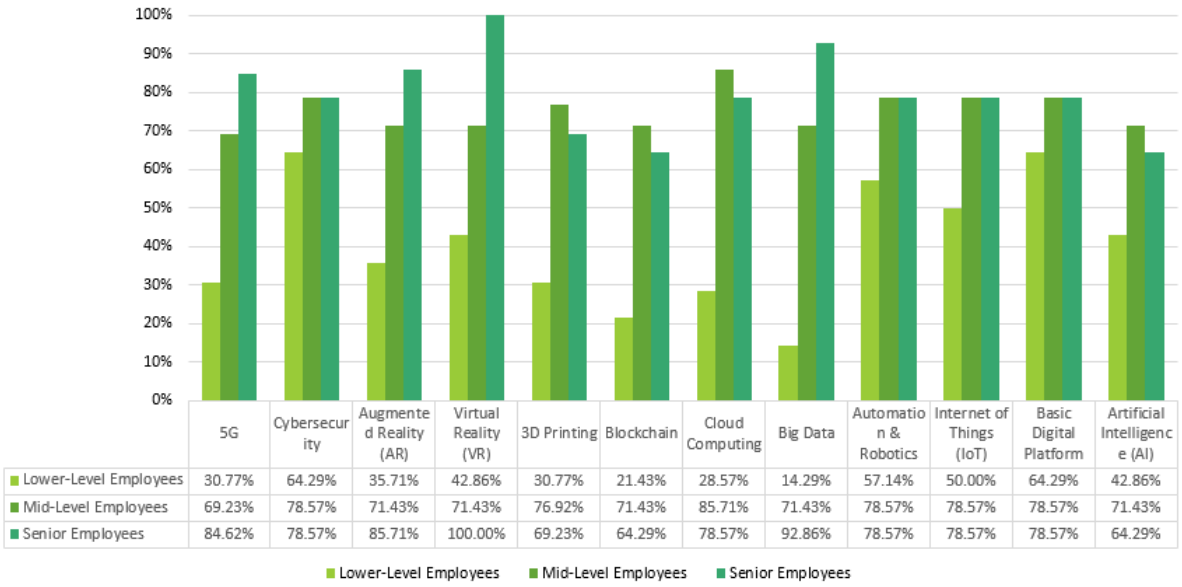
The respondents see the following employee levels requiring the following skills and knowledge in the following ET:

Survey Finding 5-3: Employee Levels and Skills Needed

Functional Area	Top 3 key ET
Lower-Level Employees	• Basic Digital Platform (64.29%) • Cybersecurity (64.29 %) • Automation and Robotics (57.14%)
Mid-Level Employees	• Cloud Computing (85.71%) • Basic Digital Platform (78.57%) • IOT/ Automation and Robotics (78.57%)
Senior-Level Employees	• Virtual Reality (VR) (100.00%) • Big Data (92.86%) • Augmented Reality (AR) (85.71%)

Source: PSETA Emerging Technology Survey, 2020

Figure 5-8: ET per Employee Level



	5G	Cybersecurity	Augmented Reality (AR)	Virtual Reality (VR)	3D Printing	Blockchain	Cloud Computing	Big Data	Automation & Robotics	Internet of Things (IoT)	Basic Digital Platform	Artificial Intelligence (AI)
Lower-Level Employees	30.77%	64.29%	35.71%	42.86%	30.77%	21.43%	28.57%	14.29%	57.14%	50.00%	64.29%	42.86%
Mid-Level Employees	69.23%	78.57%	71.43%	71.43%	76.92%	71.43%	85.71%	71.43%	78.57%	78.57%	78.57%	71.43%
Senior Employees	84.62%	78.57%	85.71%	100.00%	69.23%	64.29%	78.57%	92.86%	78.57%	78.57%	78.57%	64.29%

Source: PSETA Emerging Technology Survey, 2020

From the consultations, it was evident that majority of public employees in lower levels would require basic digital tools in understanding Cybersecurity and Basic Digital Platforms. Mid-level employees would require understanding of ET that impact day-to-day operations i.e. Cloud Computing and IOT. Senior level employees would require training in the use of Big Data analysis for strategic decision making.

> "Senior employees will have to drive the implementation and adoption whilst mid-level employees will have to ensure application".
>
> Survey Respondent.

It was also mentioned that mandatory Cybersecurity and basic digital literacy be an institutional wide training module to avoid data breaches and Cybersecurity vulnerabilities.

> "It will provide real-time answers to rather long processes that take time to complete for faster decision making."
>
> "It would assist in efficiency, stakeholder engagement, decision making and delivery and quick data collection and submission".
>
> Survey Respondent.

The ability for decision making will be improved due to real-time data and access to ET tools in understanding that data.

Where does [the Public Services Sector] organisation use the following ET per functional area?

Survey Finding 5-4: ET per functional area

Where does your organisation use the following emerging technologies?													
	Administration		Management		Planning		Policy Making		Frontline Service Delivery & Customer Service		Other		Total
Artificial Intelligence (AI)	36.36%	4	18.18%	2	27.27%	3	0.00%	0	9.09%	1	45.45%	5	11
Basic Digital Platform	61.54%	8	46.15%	6	23.08%	3	38.46%	5	46.15%	6	15.38%	2	13
Internet of Things (IoT)	58.33%	7	66.67%	8	41.67%	5	33.33%	4	41.67%	5	25.00%	3	12
Automation & Robotics	50.00%	5	10.00%	1	10.00%	1	10.00%	1	10.00%	1	50.00%	5	10
Big Data	50.00%	6	33.33%	4	33.33%	4	16.67%	2	33.33%	4	16.67%	2	12
Cloud Computing	66.67%	8	75.00%	9	25.00%	3	33.33%	4	50.00%	6	33.33%	4	12
Blockchain	30.00%	3	20.00%	2	40.00%	4	10.00%	1	20.00%	2	40.00%	4	10
3D Printing	30.00%	3	10.00%	1	10.00%	1	10.00%	1	20.00%	2	60.00%	6	10
Virtual Reality (VR)	30.00%	3	30.00%	3	20.00%	2	0.00%	0	10.00%	1	50.00%	5	10
Augmented Reality (AR)	22.22%	2	33.33%	3	11.11%	1	11.11%	1	11.11%	1	55.56%	5	9
Cybersecurity	64.29%	9	57.14%	8	28.57%	4	35.71%	5	35.71%	5	21.43%	3	14
5G	30.00%	3	60.00%	6	20.00%	2	10.00%	1	30.00%	3	50.00%	5	10

Survey Finding 5-5: Top 3 ET per Functional Area

Functional Area	Top 3 key ET
Administration functions:	• Basic Digital Platform • Cloud Computing • Cybersecurity
Management functions	• Cloud Computing • IOT • 5G
Planning functions:	• Cloud Computing • IOT • Blockchain
Policy Making functions	• Basic Digital Platform • Cybersecurity • Cloud Computing
Frontline Service Delivery:	• Cloud Computing • Basic Digital Platform • IOT

Source: PSETA Emerging Technology Survey, 2020

From the consultations, it was evident that majority of these ET would be applied to aid in administration processes, planning and management functions. The trend emerging for the discussion pointed to more use around Cloud Computing, Basic Digital Platforms, Big Data and Cybersecurity being mentioned often in the application of administrative and management functions.

For the following skills, indicate which are required by employee levels AND may be impacted by ET:

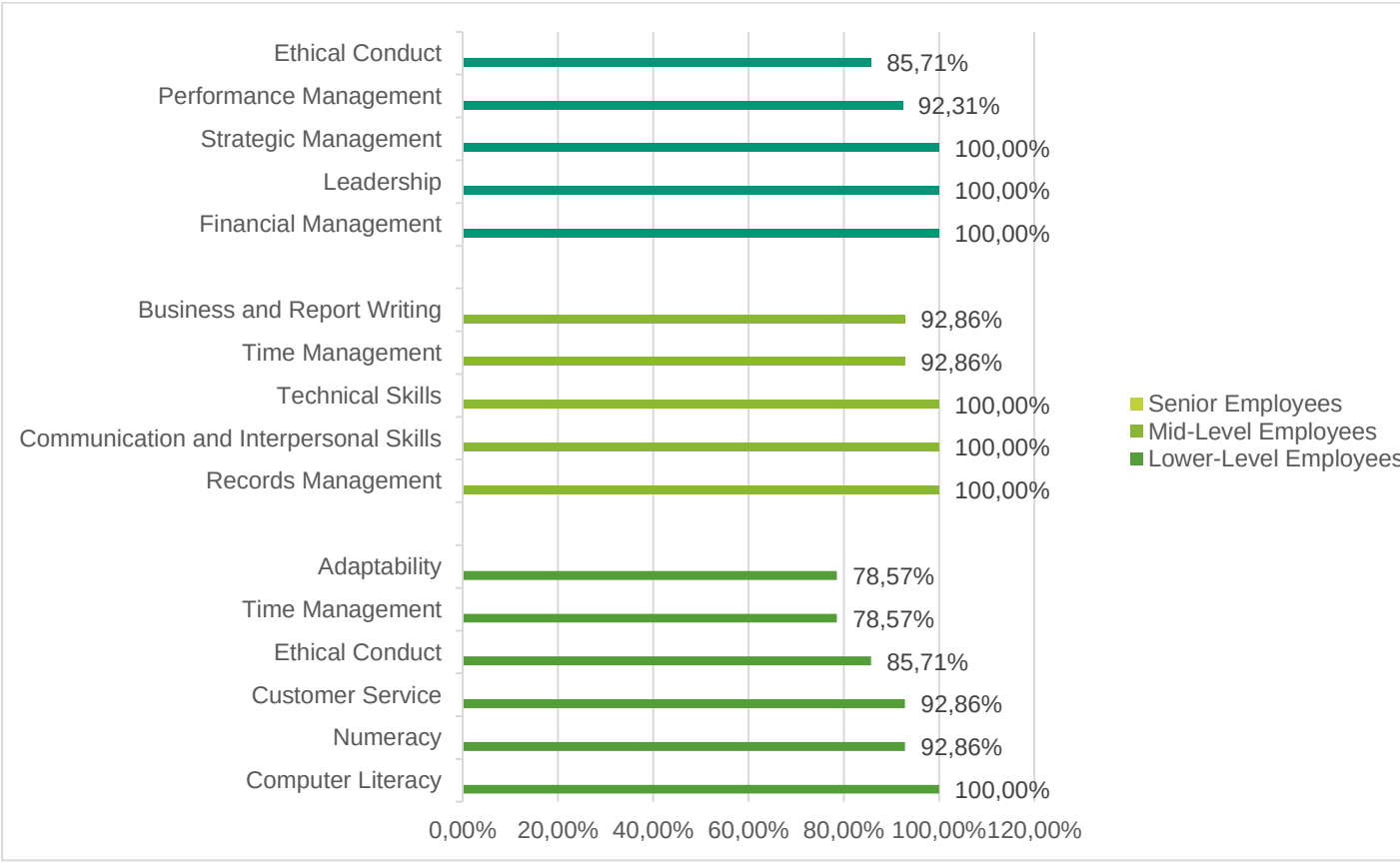
The respondents see the following employee levels requiring the following skills in order to support ET:

Survey Finding 5-6: Top 3 ET per Employee Level

Employee Level	Top 3 key Skills Needed for ET
Lower-Level Employees	• Computer Literacy (100.00%) • Customer Service (92.86 %) • Numeracy (92.86 %)
Mid-Level Employees	• Communication and Interpersonal Skills (100.00%) • Records Management (100.00%) • Technical Skills (100.00%)
Senior-Level Employees	• Financial Management (100.00%) • Leadership (100.00%) • Strategic Management (100.00%)

Source: PSETA Emerging Technology Survey, 2020

Survey Finding 5-7: Top 5 skills per Employee Level:



Source: PSETA Emerging Technology Survey, 2020

From the surveys, it was evident that majority of public employees in lower levels would require Compute Literacy, Customer Service and Numeracy Skills. Mid-level employees would require Communication and Interpersonal skills, Records Management and Technical skills in day-to-day operations. Senior level employees would require skills around Financial Management, Leadership and Strategic Management.

> "In the short to medium term the technologies would augment existing work and help with efficiency gains. Skills would therefore be requiring to 'command' and apply these technologies. As these technologies become more ubiquitous, they will replace a number of functions. As such, it would require additional systems integration, deployment and coordination skills from mid and senior management as well as softer change management and ethics capabilities."
>
> Survey Respondent.

During the consultations, Basic Digital Skills was often highlighted for lower level employees, while more emphasis on Change Agents and Leadership was placed on senior and mid-level employees.

How could the Public Services Sector be better positioned to handle change?

Respondents mentioned that there needs to be awareness sessions, online training, mentoring through their respective managers. Furthermore, training needs to happen regularly through re-skilling and re-training, and the use of increased funding towards relevant training and capacitation of employees.

Majority of respondents highlighted change management being a key barrier that needs to be managed effectively. Some examples of effecting change management are through workshops, courses and conferences. Providing change management sessions will reduce fear of the unknown associated with change, as well as the mistrust in technology for some employees. In order to further reduce ET inertia, clear communication that separates the facts from fiction and fallacy needs to be communicated effectively to meaningfully shift mindsets and in order to meet the demands brought to the fore by change.

6. Enablement Environment

This section highlights the impact ET have had on the Public Services Sector. The sub-sections explore the enablement environment, and how this fits into the adoption of ET. Furthermore, some literature discusses why collaboration and coordination are key to implementation success. During this section, the research findings are discussed in detail from the consultations that includes both qualitative and quantitative feedback. Recommendations and thematic trends are, thereafter, presented in Section **8**: *Key Findings and Recommendations.*

6.1. Infrastructure, Coordination and Collaboration Factors

This section considers the pre-cursors to utilising ET, which is a sound infrastructure, coordination mechanisms and robust collaborations through partnerships in order to enable the use of 4IR and ET.

Whilst previous expenditure on brick-and-mortar i.e. face-to-face infrastructure, was prioritised in delivering public services pre-COVID-19, due to the physical current nature of public services and administration in office locations, this had not prioritised the use of digital technologies, along with budget cuts and restrictions.

> "At the dawn of COVID-19, we should stop procuring chairs and desks, and procure decent laptops and data, so that individuals can work remotely."
>
> Interview, (Gauteng Department of e-Government, 2020)

This had constrained the various Departments from attaining digital tools of trade which, in hindsight, would have led to a more robust working remotely strategy. Digital tools of trade are part of the enablers towards 4IR and ET use. This not only aids in delivering training but also acts as a virtual office through remote working, creating productive outcomes. Without laptops and data, digital strategies are worthless. Furthermore, the access to broadband and its low bandwidth ability have been presented as major issues around a governmental strategy towards going digital.

Majority of National and Provincial departments use basic emails for their day-to-day activities with most using completely manual, and paper-heavy processes.

> "4IR will struggle in government with the infrastructure that we have".
>
> Interview. (National School of Government, 2020)

The basic underlying infrastructure, such as electricity supply, data and WIFI along with the tools or trade i.e. laptops – are enabling tools towards going digital. Other important aspects, such as training and upskilling, also require these resources for simulated training and learning environments. For this reason, it's a bit of a double-edged sword or the chicken and the egg dilemma (what comes first?), whereby, you can develop the correct skills and competencies, but then the tools of trade are missing and vice versa, where you have the tools but are not trained in its use.

Laptops and 3G cards need to be deployed across all levels and not solely at the middle to senior management level. Low access to digital tools of trade, result in low reaching ET applications.

> "Only SMS and MMS management levels have access to digital tools. This makes remote working very difficult to implement across the lower operational levels".
>
> Interview. (National Treasury, 2020)

Working remotely was cited as an issue, where majority of respondents mentioned that there are connectivity issues in some areas which causes inaudible and poor communication, with tools of the trade not being provided across all employee levels. Furthermore, the use of connectivity and data bundles are insufficient for working online.

Load-shedding will be with us for some time, and for that reason, also places a burden on the use of ET that require electrical supply.

Furthermore, many National and Regional Departments voiced concerns around the low bandwidth provided by SITA as well as access and cost of data being a limiting factor. Key discussions with SITA need to be had, as we cannot be 4IR with 3IR ways of approaching IT.

> "The current model is centred around 3IR business models, especially at SITA, where we have an old way of doing and supporting I.T. When it comes to emerging technology, we need to adapt to the times, in order to be 4IR ready."
>
> Interview, (Public Service Innovation Centre, 2020)

Respondents mentioned that there is a need to invest in IT infrastructure in line with the introduced changes which will better align and position them to handle change.

Furthermore, coordination also plays a role in attaining a country-wide drive towards ET use in the sector. The lack of coordinating mechanism and guidance from the top-down and across Departments will also hinder a unified National approach.

This is why, as outlined by Infodev (2009), in order to successfully implement an e-Government, both a top-down and bottom-up approach is needed. This is also related to the design and management of the e-Government strategy, policy and standards which should be overarching and applied holistically. This needs to align with the intent and vision of the Government's broad strategy/goals and objectives. Within individual initiatives or projects a more granular approach centred at the individual departments level is needed. This will consider and depend on sound governance and decision-making disciplines being applied while managing change, institutional culture, capacity-building and active involvement across all stakeholder levels. This also speaks to National co-ordination and collaboration mechanisms with public-private partnerships (PPP).

> "Our stakeholders are the heart of the economy i.e. the automotive industry but when it comes to government – emerging technology is still in its infancy. PPP is critical in unlocking faster innovation."
>
> Interview, (Eastern Cape Office of the Premier, 2020)

Within government capacity, the government must demonstrate its ability to provide credible and quality public services while ensuring a high degree of independence from political pressures. The success of e-Government also depends on the availability of particular organisational knowledge, public trust, social, economic and technological infrastructure. Providing or not providing all this infrastructure can positively or negatively influence the successful implementation of e-Government (Roblek et al, 2019).

Small steps can be taken through the adoption of use-cases and pilot programs. There are not enough widely distributed pilot projects that are trialled and evaluated. Use-case success stories are also not discussed enough creating a momentum, building trust and talking points for ET use in the sector.

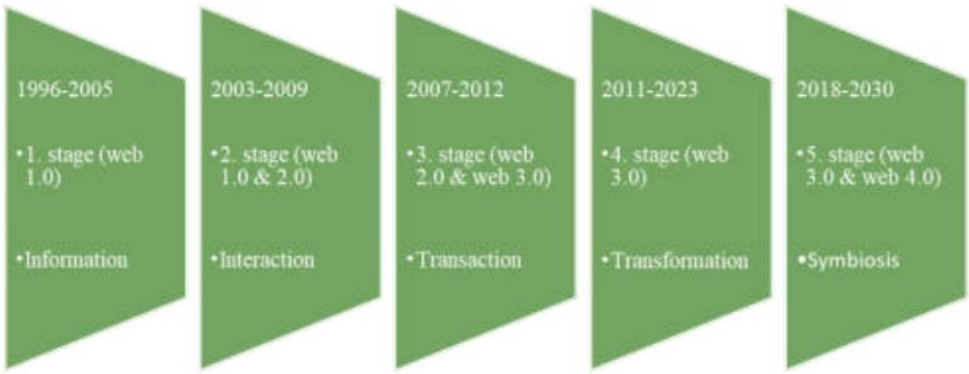
> "We need to identify the technology for improving performance management through online portals and tables. Let's do a pilot initiative and then scale it".
>
> Interview. (Free State Department of Agriculture, 2020)

Cultural factors as well as the institutional culture play an important role in change management and effective communication. Change management and communication is sighted as one of the key barriers to implementing innovation and ET in government.

A further analysis of the Public Services Sectors key coordinating mechanisms and ecosystem needs to be mapped out and the current state analysis as to understand where the various Provinces sit on the e-Government maturity model.

Roblek et al. (2019), e-Government maturity model shows the key development stages are assigned according to web technology developments. Various Provinces are at different maturities, i.e. some are currently in the second stage - interactions, whilst others are still at the transactional stage. The two most advanced would be the Gauteng and the Western Cape.

Figure 6-1: e-Government Maturity Model



Source: (Roblek et al, 2019)

The designs of e-Governmental solutions in the transactional stage (stage 3) should include organisational structures of public administration that focus on the reorganising

of back – offices, using sophisticated backend system technologies. It should also complement, contribute and map the fourth stage, which incorporates technical substructures (standardisation of data structures, engineering of protocols for data exchange, and cryptographic challenges for digital signature). The fourth stage is based on process reengineering, interconnected databases held by different bureaus, digital identity and APIs (Roblek et al, 2019).

Furthermore, this needs to talk to a National Cyber-Security Strategy along with alignment with Laws and Policies on Privacy and Data Protection and Laws on Access to Government Information along with authorisation, public key infrastructure and e-signatures.

When respondents were asked of the risks of working remotely, it was noted that respondents believed cybersecurity is a main risk while working remotely. Whilst others mentioned not having access to some of the resources e.g. printing, signing on actual/original documents needed to do their work.

The National School of Government and the Department of International Relations require a way to ensure e-signatures are secure and aligned in order to consider a paperless process.

> "A department wide national e-signature process needs to be developed."
> Interview, (National School of Government, 2018)

The reliance on physical signatures is also limiting the use and integration of digital solutions. This also speaks to the audit function, which is still heavily reliant on a paper-trail.

> "The Department didn't have a formal electronic signature, to view and sign documents. Since April, they introduced e-signatures, some staff are still struggling."
> Interview, (Department of Trade and Industry, 2020)

These outdated external processes are not digitised and act as a compliance barrier to implementing digital technologies.

> "Compliance and audit processes required by the National Treasury and DPSA are very much manual and paper based. This places a compliance barrier. These external processes are outdated and will stem the use of digital technologies."
>
> Interview, (Public Service Innovation Centre, 2020)

Trust is essential in the uptake of using ET. Some interviewees believe that government email servers are not secure and that they will be more vulnerable to data breaches if they embrace technology. This is why a robust cybersecurity policy and training needs to be provided to all level Public Services Sector employees.

> "There are issues related to security and fear in placing documents in the cloud, with safety of data being a major concern and cybersecurity."
>
> Interview, (Eastern Cape Office of the Premier, 2020)

Furthermore, data records, and content management through system and communication interoperability are essential in enabling a successful e-Government.

> "Data-driven policy development and service design could benefit most from emerging technologies, especially those in the Big Data domain."
>
> Survey Respondent

This speaks to an alignment between National, Regional/Provincial, Local and Municipal government is needed.

> "There are underestimations of emerging / 4IR technologies and digital transformation coupled with a lack of, a common understanding of these terminologies and a misalignment on what these technologies actually mean."
>
> Interview, Department of e-Government Gauteng, 2020

In order for South Africa to transition and move up the e-government maturity model framework, a lot of work needs to be done. As outlined, the key enabling infrastructure being the primary concern.

The first world is currently at the fourth transformation stage of e-Government, together with a fifth stage, includes the development and implementation of digital models of e-Democracy, participatory governance, and open data. The digital divide globally is widening and South Africa need to address the Provincial and Department wide digital adoption discrepancies.

Attaining the fifth stage would mean that the goals of the new models are to ensure the development of cyberspace and urban data platforms as alternative e-services channels. Platforms are expected to provide greater transparency, openness, accountability and citizen participation in a government's decision – making processes (Roblek et al, 2019).

South Africa would still be seen as being at the split-levels of the second and third transformation stage.

With foresight, moving from paper to digital would require the Public Services Sector needing to consider data warehousing in a cyber environment, the issue of monopolising the disposition and trading with public data must be emphasised. Public data has substantial value for business and society. Data and data management become core components for success and competitive advantage in many industrial and Public Services Sectors, value chains or organisational processes and, thus, a decisive factor for public policies and business decisions. Appropriate legislation should prescribe what public information is freely available and with which public authorities it can be traded with, in data stock exchanges, along with figuring out what will prevent monopolisation and possible misuse of resale and use of data in advance (Roblek et al, 2019).

Key and We (2009), view smarter government as enabling smart information technology government operations such as establishing a government-wide, fee-based IT expert centre/clearing house, organising cross-agency collaborative working groups for every IT field, providing an infrastructure for educational training and easy online access to technical papers, and instituting procurement strategies anchored on technical expertise and cross agency cooperation (Gil-Garcia et al, 2014).

In order to implement a service-wide e-Government strategy, substantial amounts of implementation efforts would be devoted to pursuing a coordinated and effective service- and commodity-wide e-Government strategy. This is where governments need to tangibly delineate the development of government-wide IT frameworks, infrastructures, as well as, architectures that are prone to establish overarching public service design principles and achieve open interoperability (Kwok, 2014).

> "It's difficult to integrate different functions across I.T Systems – as they are not always compatible and interoperable across new and legacy systems. A one system for all will be a challenge."
>
> Interview, (KZN Office of the Premier, 2020)

Coordination and a uniform approach in an orchestrated effort is also important in being compliant holistically with data best practices and regulations such as Protection of Personal Information Act (often called the POPI Act or POPIA).

The Department of e-Government Gauteng uses councils and specialised forums open to discussion, as well as for input are key in driving innovations, while hearing all stakeholders factoring in input while ensuring compliance, security and ethical considerations are in alignment. The creation of a collaboration environment creates a platform for enablement (Gauteng Department of e-Government, 2020).

> "We have a transparency council set up, keeping all stakeholders in a holistic loop of trending emerging tech, skills and initiatives. This is a dialogue box for mandates. We also have a cyber security forum which is a key component of ensuring safety."
>
> Interview, (Gauteng Department of e-Government, 2020)

The role of a National coordination mechanism should not be underestimated. We have seen cases where regional departments have implemented e-Government successfully from the bottom-up, while the more common method, through the top-down approach, i.e. South Korea, Estonia, Sweden, have all been supported form the National level with an administration continuity.

We cannot express the importance of the political buy-in, will and follow through needed on the National level.

> "A key to technological continuity and success is during the "changing of guard", that there is a continuation from one administration to the next, so that they can pass-on the baton, to implement".
>
> Interview, (Gauteng Department of e-Government, 2020)

Ideas around how an e-Government strategy can be rolled out needs to be outlined: how will it be resourced, sustained and have political momentum during and after the handover from one administration to another, in order for it to be a continued success.

Since e-Government involves the digitisation of data, National security needs to be top-of the agenda, while interoperability across systems through application

programming interfaces (APIs), e-signatures and cryptography plays a role while enhancing privacy and data anonymisation.

In South Africa, the Department of Public Service and Administration (DPSA) is responsible for the development and coordination of government's overall e-Government strategy. Key legislation for e-Government is the Public Service Act of 1994 and its subsequent amendments. This Act provides for, amongst others, the establishment of norms and standards relating to e-Government and information management in the public service. The White Papers on Transforming Public Service Delivery (WPTPSD), Promotion of Access to Information Act, Electronic Communication and Transaction Act, Electronic Government Policy Framework, Minimum Information Security Standards (MISS), Minimum Interoperability Standards (MIOS) and Policy on Free and Open Source Software (FOSS) discussed the concept of e-Government. Collectively, these frameworks promote transparency, accountability, good governance, information security, and freedom in the acquisition and use of IT. The South African government has established statutory bodies to co-ordinate implementation of e-Government projects. Amongst these are the State Information Technology Agency (SITA) and Government Information Technology Officers Council (GITO Council). SITA is responsible for the acquisition, installation, implementation, and maintenance of IT in the Public Services Sector. The GITO Council, which consists of National and Provincial IT officers, is responsible for consolidating and coordinating IT initiatives in government, including e-Government, to facilitate service delivery (Department of Communications, n.d.)

Therefore, the Public Service globally will be adopting many different innovations and ET in order to become an open government, that interacts and engages its citizens. This also looks at ways to improve interoperability within and across departments through improved information sharing, efficient and cost-effective communication and through transparency.

Transparency will be the opportunity for governments to open up the budgeting process with a betterment of service delivery whilst monitoring the use and allocation of fiscal funds. In order to do this, governments will need to facilitate accompanying culture shifts and capability enhancements which will look at how information management can be made simpler, while still meeting compliance and analysis of government regulations. The creation of inclusive programs that provide a

collaborative citizen-city government interaction are the ideals in using 4IR and ET to enhance service infrastructures and public service delivery (Gil-Garcia et al, 2014).

> "Emerging tech will have a positive impact if the infrastructure allows."
> Survey Respondent.

The first step towards using ET is to transform towards, a paperless government enabled through new data policies and procedures. This needs to be reinforced and prioritised with enhancing the infrastructure, through faster broadband and ubiquitous connectivity, along with digital tools of the trade are essential in attaining and enabling the ideas of 4IR and ET in public service delivery. As "4IR will struggle in government with the infrastructure that we currently have".

The next section will explore respondents' thoughts on COVID-19 and how this has paved the way for a more acceptable view towards ET use within the Public Services Sector.

7. The COVID-19 Effect

COVID-19 swept across the globe with devastating effect, many lost their lives and others lost their livelihoods from economic ramifications. The global response to stop the viral spread, was to lock down, or stop the public from spreading the infection by confining civilians to their homes, over a period of time, with a hope of stemming the infections.

The pandemic had brought economies to a standstill. The Public Services Sector alike, is not immune to the impacts that such a drastic closure of the economy has created.

In line with the National skills shortage provided by MICTSETA SSP (2019); (2017), in Section **5.2** along with the global backdrop of the COVID-19 pandemic, has shown that, the skills gap needs to be developed and capacitated. COVID-19 has also accelerated and pushed the agenda for the use of digital technologies in all sectors, especially the Public Services Sector which had completely come to a standstill during the nation-wide lockdowns.

> "We have adhered to implementing social distancing, spacing and PPE protocols to fight COVID-19, and reduced overcrowding in offices. We are still struggling and have moved to virtual meetings where we can."
>
> Interview, (Mpumalanga Office of the Premier, 2020)

COVID-19 has also exposed weaknesses within business continuity models with wide-ranging disparities across Provinces, especially for those that had previous socio-economic issues, further hindering the use of ET. The Eastern Cape Office of The Premier mentioned that the COVID-19 surprise, dampened their prioritisation of connectivity and broadband, where they were mid-way in implementing upgrades when they were affected by rising cases and lockdown issues. The Eastern Cape has ideas around ET usage, but cannot implemented based on these socio-economic barriers (Eastern Cape Office of the Premier, 2020). A similar situation is playing out in Mpumalanga where allocating funds towards ET are scarce and large amounts of assistance is needed (Mpumalanga Office of the Premier, 2020)

> "We have been caught off-guard due to COVID-19. Technology will provide benefits in cost savings with resources better deployed to aid the socio-economic agenda."
>
> Interview, (Eastern Cape Office of the Premier, 2020)

Therefore, the skills shortage issue has now been magnified with the advent of COVID-19 drawing attention to much needed skills demand, while resources are constrained and budget cuts hinder the developing of digital solutions.

> "We have been struggling with COVID-19 and were not prepared. PSETA needs to intervene so that we are able to move from being a traditional institution based on paper to new forms of technology in improving skills, service delivery and institutional resilience".
>
> Interview, (Mpumalanga Office of the Premier, 2020)

Furthermore, this has also led to new insights that ET can have in disaster situations and towards an institutional acceptance towards remote working. COVID-19 has pushed the agenda towards e-Learning, access to digital tools of the trade and Public Services Sector acceptance of remote ways of working.

> "Mind set shift from the old way of doing things to new normal work. Many jobs are obsolete because they cannot be done anymore due COVID-19 Pandemic e.g. less training administration because training is more self, distance and virtual learning than classroom training. Effective change management is required".
>
> Survey Respondent

This has also shown the Public Services Sector that it needs new ways to adapt, while upskilling and reskilling requirements have become a mandatory requirement, specifically around basic digital skills. The next sections will consider ET and its ability to facilitate learning or e-Learning.

> "The current COVID19 situation challenge was to learn by doing with the OTP thrown into a virtual platform that you know very little about."
>
> Interview, (KZN Office of the Premier, 2020)

Moving to a virtual world, has been a challenge for most National and Provincial Departments, part socio-economic and resourcing, part training and digital tools of trade, and part due to the underlying infrastructure capabilities within the Public Services Sector context.

Some Departments had made the move prior to COVID-19, through serendipity or foresight, in deploying Laptops and 3G cards to staff, in order to work remotely and staying connected through virtual conferencing platforms.

> "The Department is no stranger to working remotely, before COVID-19, a fire at one of the GPG departments made us shifted to working remotely".
>
> Interview, (Gauteng Department of e-Government, 2020)

Many South African departments at the National and Provincial level had been thrown into a situation that seemed temporary, but is slowly becoming a new normal. This is amplified in the way society, business and the Public Services Sector functions and interacts with its stakeholders, at a distance.

> "COVID-19 has fast tracked e-Learning and remote working skills along with new ways of working and interacting. This has pushed us, the Public Services Sector, into the virtual world, we either need to sink or swim by embracing this new world we are heading into."
>
> Interview, (Western Cape Office of the Premier, 2020)

COVID-19 has hastened our thinking of the use of technology in the workplace. It is something that will change the future of work. In the previous sections we will have seen how a paper-driven society cannot support a move towards a digital society. Therefore, there is a need to digitise and as we have seen from some of the interviews, this is viewed as a mandatory future view.

There is a dire need to move towards e-Government models and toward a paperless system that supports digitisation and the Public Services Sectors resilience in times of extreme events.

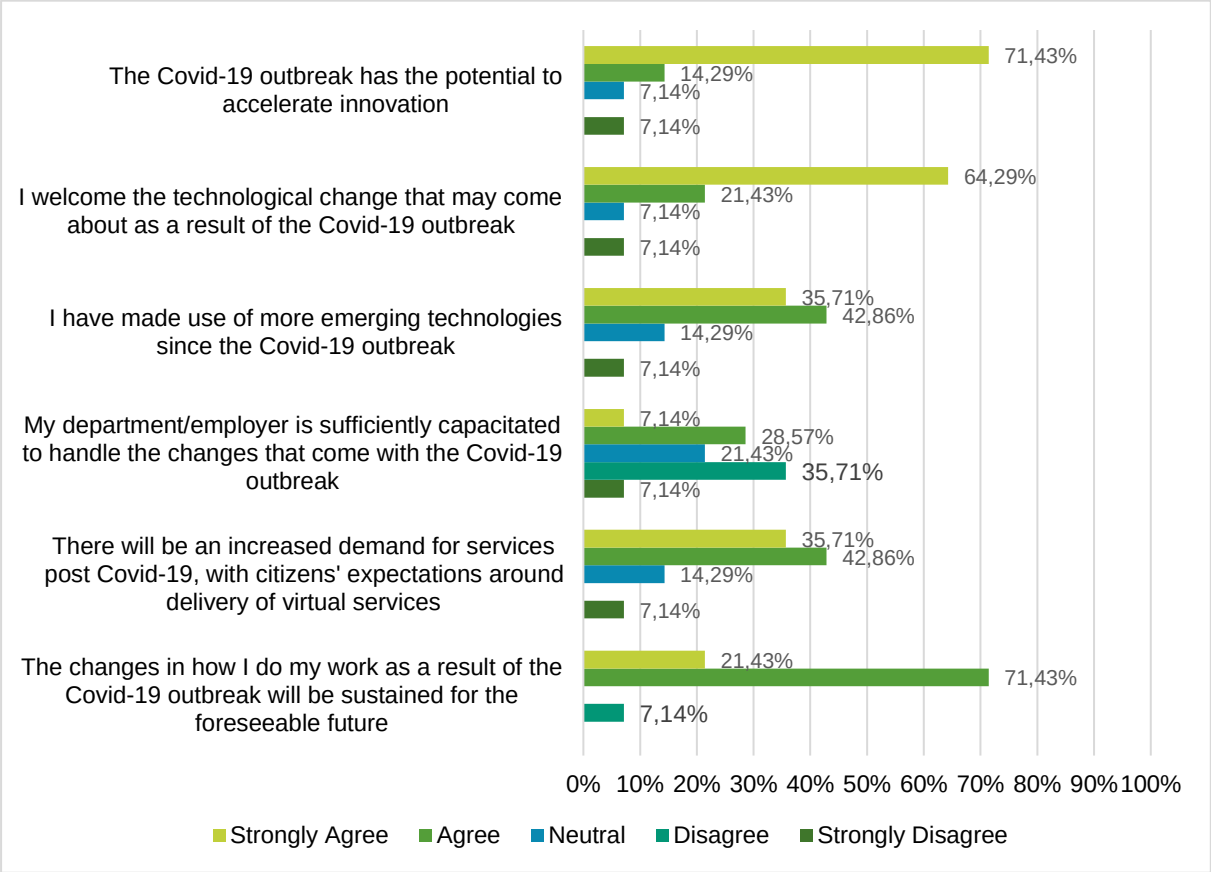
Within the National and Provincial departments, respondents answered the following in terms of the use of ET within their Departments. This is the aggregated view across the respondents in the Public Services Sector:

To what extent does [the Public Services Sector] agree with the following statements?

The respondents strongly agree that COVID-19 has accelerated the use of innovation with technological change being more accepted than pre-COVID-19. Furthermore, 42,86% agree that they have made use of ET since COVID-19, while 43% believe they are not sufficiently capacitated to handle the changes brought by COVID-19. Most

respondents agree that, due to COVID-19, increases in services demanded by citizens will be delivered virtually and that changes posed by COVID-19 will be sustained in the foreseeable future.

Survey Finding 7-1: Impact of COVID-19 and ET



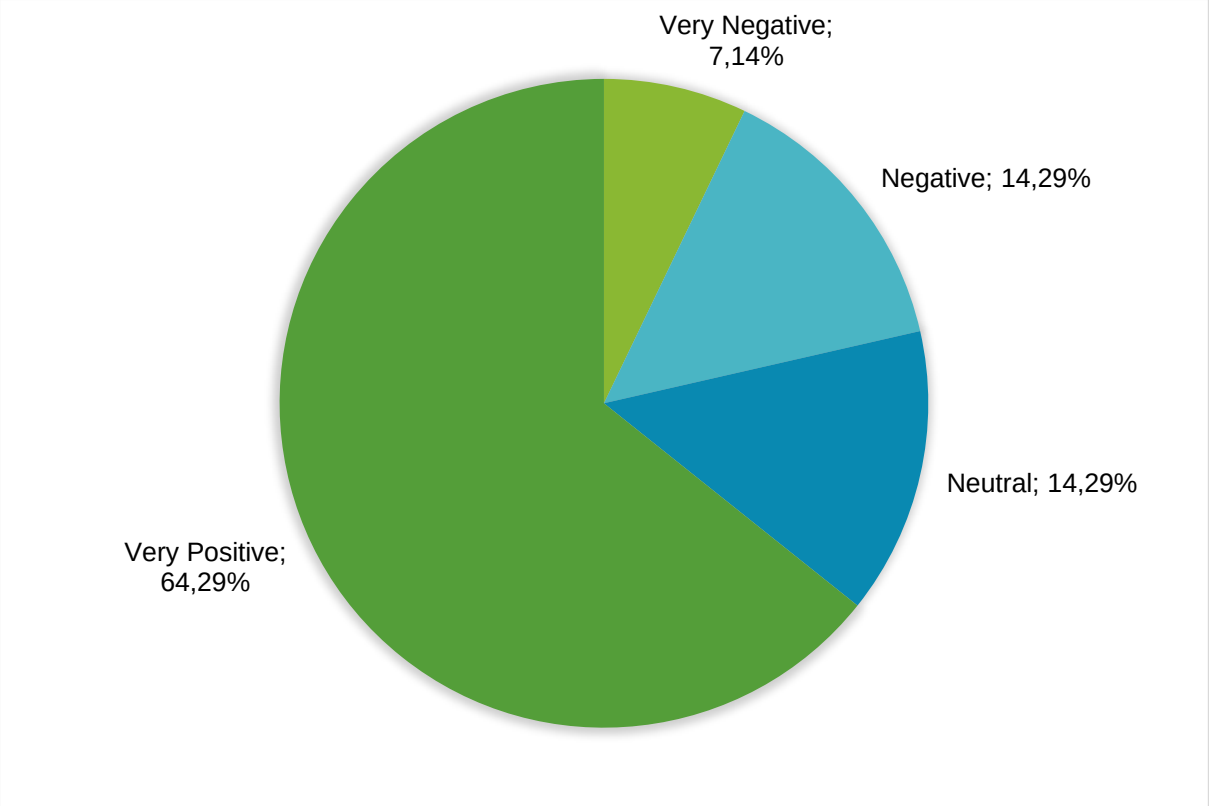
Source: PSETA Emerging Technology Survey, 2020

The consultations reinforced the above survey data, with interviewees seeing a larger role of ET being implemented in their Departments. The overall sentiment towards the use of technology is positive and is recognised as having a sustained role to play today and, in the future, due to COVID-19 driving the adoption of technology usage. However, many National and Provincial Departments are under-resourced in providing the digital tools and training required, to move into virtual or remote settings.

What type of impact does [the Public Services Sector] think the Covid-19 outbreak will have on the way [they] do [their] work?

Majority of respondents believe that the COVID-19 outbreak will have a positive impact on the way work is done.

Survey Finding 7-2: Impact of COVID-19 and Ways of Work



Source: PSETA Emerging Technology Survey, 2020

> "It will foster a culture of independence, time management, creativity, deadline driven, integrity. A move from a typical public servant to a professional, that is more resilient".
>
> Survey Respondent.

What (if any) are some of the new technologies that [the Public Services Sector] have been exposed to more since the Covid-19 outbreak?

Respondents mentioned exposure and use of virtual online platforms such as Microsoft Teams, Zoom and use of Cloud based software such as Microsoft 365 and Azure. Furthermore, there was a growing trend and interest around online e-Learning platforms in delivering training remotely.

8. Key Findings and Recommendations

The table below outlines key findings and recommendations to resolve areas of development when it comes to ET and its implications for skills development and use within the Public Services Sector.

Table 8-1: Key Findings and Recommendations

	Focus Area	Key Findings	Recommendations
1	**Partnerships**	• Various stakeholders have indicated that it would be beneficial to enhance other SETA partnerships. • Various stakeholders have indicated that it would be beneficial to enhance and strengthen PPP partnerships with technology-based blue-chip corporations and academia. • Various stakeholders have highlighted their reliance on the National School of Government to deliver specific training. • Various stakeholders highlighted the need to recognise recognition of prior learning specifically when it comes to private vendor certifications in ICT.	• Continue current practice. We acknowledge that the PSETA currently arranges stakeholder forums where sector specific updates are provided, and knowledge is shared amongst stakeholders. • Act as a catalyst. The SETA cannot effect change within the Public Services Sector by itself, but it can connect stakeholders, learn from each other and share experiences as to how they are managing the impact of the 4IR. • Partner with other SETAs. It is important to partner with other SETAs (MICTSETA for example) and formulate a coherent approach in dealing with 4IR related skills as there may be a significant overlap in challenges and opportunities being faced across sectors. This unified approach is likely to be driven by DHET. • Consider creating global partnerships. This can facilitate fast learning taking learning curves from international best practices. Example: partnering with Microsoft, SAP or Google in acquiring new skill sets. We further note that the above

	Focus Area	Key Findings	Recommendations
			would further the principle encapsulated in the NSDP, being "Increasing collaboration between the skills system, government and industry" • Collaborate and engage with the NSG to see how content can be leveraged and delivered. Furthermore, this also speaks to the Public Services Sector Curriculum. So that in-demand, timely and relevant courses through insights in the WSP and ATRs can lead to faster curricula adaption. • Engage with the QCTO. Short-courses are not formally NQF recognised. The SETA needs to see how more recognition for prior learning can be achieved. This is especially true for continuous technology changes and when it comes to technical skill sets e.g. Microsoft Azure training
2	**Training at School Level**	• Stakeholders have indicated that it is best to start 4IR training at school level, as opposed to waiting until an individual enters the job market. • There was also indication that the school curricular is reactive rather than proactive.	• Share findings with Department of Basic Education. The SETA should share its findings to assist with the structuring of school curricula to account for job market requirements, insofar as this relates to 4IR requirements. Align curricula towards what the market may require in the next 3 to 5 to 10 years. • Build basic digital skills. The SETA should fill this skills gap required as the foundation for all ET. • Develop innovation and entrepreneurial based-curricula is

	Focus Area	Key Findings	Recommendations
			key to ingraining change and adaptability at a young age as a key trait.
3	**Change Management**	• Numerous stakeholders have cited the need for change management practices to take place in order to manage the change being brought in by ET. • A suggestion from stakeholders appears to be that employees will need to buy-in to the concept of ET in order to find a space for them to still be productively employed. • Lack of trust, in technology is creating barriers to the successful and experimental uptake of ET.	• Equip and train employees in change management skills. In addition to equipping employees with technical skills required to manage 4IR technologies, focus is also given to training employees on change management techniques • Increase conferences and workshops mentioned above in focus area 1, in addition change management should also be explored. • Create a mandatory focus on basic foundations of cybersecurity and technology best practices training. This should be a ubiquitous and mandatory module to aid in employee insecurity and mistrust of technology. • Increase incentives and KPIs focused on technology adoption to bolster technology trust. New technology adopters should not be penalise or create adverse behaviours to technological experimentation.
4	**e-Learning enablers**	• An overwhelming response by stakeholders was on the lack of access to digital tools. • Additionally, other concerns highlighted were around low bandwidth available accompanied by the general cost of accessing data to enable the digital tools.	• Provide access to laptops and 3G/4G/LTE/5G data cards. A more ubiquitous access needs to extend across all Public Services Sector levels if required for remote or virtual working. This is also a pre-requisite for e-learning. • Procure better quality data lines. The detracting feature of low

	Focus Area	Key Findings	Recommendations
		• There was also mention of blocked access to video streaming services and training videos through other 'non-approved' SITA platforms.	bandwidth is that is does not offer rich content, webinars or online lecture capturing and streaming functionalities and is limiting the ubiquity of e-Learning platforms. • The SETA to consult the SITA. Discussion are to be had around the use of more suitable video streaming or changes to site restriction rules in order to make content more widely available 24/7. • Realign the evaluation and moderation process. This needs to be updated in being e-Learning friendly and virtual facilitations.
5	**Uncertainty surrounding the impact of COVID-19**	• In the short-term there is uncertainty surrounding the impact that 4IR will have as the Public Services Sector scrambles to 'go-remote or virtual" in keeping their departments operational in this global pandemic. • Stakeholders consulted were of positive views on the impact that ET is likely to have on service delivery in the future. • All stakeholders where of the view that COVID-19 has created more acceptance around technological use to streamline and digitise paper work, while leading to cost savings in training and development.	• Promote access to digital tools. This was overshadowed by the lack of resources and tools of the trade as well as training around digital tools dampening their remote working ambitions even though this is highly possible. • Training focused around use of Microsoft Teams and other virtual office software to socialise public users while boosting their confidence. • The SETA should consider undertaking virtual roadshows to schools to educate learners regarding new career paths within the Public Services Sector space and the importance of digital skills given COVID-19 and the future of skills.
6	**Change that is driven from the top**	• There is still a skills shortage that exists in the country. A digital divide is occurring where by gaps between	• Upskill and reskill senior employees in 4IR related skills in order to leverage 4IR technologies and

	Focus Area	Key Findings	Recommendations
		those who have and do not have access to technology. • Whilst it is important to upskill lower occupational categories, a key finding in this report is that there is likely to be a high demand among senior managers for 4IR skills specifically around change management, leadership and digital tools.	cascade these skills down to lower occupational groups. • Bridge the digital divide, by providing lower occupational levels with training and access to digital tools. • Develop leadership and change management in senior employees as the drivers of the change.
7	**Impact of negative external economic factors**	• South Africa is experiencing a general trend of reduced economic activity. This places all sectors at risk of facing a period of reduced expenditure and budget cuts taking place nation-wide placing more pressure on training providers to maximise socio-economic returns.	• Implement project prototypes in order to see if a viable solution can be scaled once tried and tested. This will also create momentum for 4IR and change. • Focus prototypes on the ET that increases service delivery, increases effectiveness and efficiency, lowers costs in the provision of government services. • Promote use-cases that increase efficiency and reduce costs, e.g. predictive analytics, in order to help protect employees in a difficult economic climate as the institutions has funds it can mobile or reinvest into further training and development.
8	**Inadequacy of training programmes**	• Current training programmes have limited focus on responding to ET. • In addition, programmes tend to take too long to develop, whilst change is rapid.	• Improve the time it takes to update or develop programmes. • Improve the consultative processes for updating or developing courses by accelerating the process to include interested parties. • Introduce and/or emphasise unit standards on soft skills. This is expected to improve learners'

	Focus Area	Key Findings	Recommendations
			mobility and employability within the Public Services Sector. • Introduce and/or emphasise unit standards on cybersecurity. This is expected to boost learner's morale and technology confidence. • Whilst programmes are relooked at to include more emphasis on soft skills, short programmes can fill this void. • Focus on recognition for prior learning and acknowledging technical programs that are sought after in the market place i.e. Microsoft Azure Developer certifications.
9	**Infrastructure and Tools**	• Basic infrastructure including the tools of trade, data and WIFI need to be ubiquitous across government levels. • There is a high use of personal equipment and sources used in working remotely, and only senior managers have access to these resources.	• Remodel how skills capacitation functions and is delivered. That is, how digital tools are provided and fit into the training. • Collaborate with SITA in understanding how to move from a 3IR to a 4IR in providing more effective infrastructure or pilot programs in order to complement the investments made in skills development programs.

9. Conclusion

In conclusion, the assignment gathered evidence on the prevalence and examples of ET, as implemented by various departments of the Public Services Sector. The following are some of the key points that have been highlighted.

Opportunities and threats presented by ET to the Public Services Sector processes.

Since the use of ET in the Public Services Sector in general is still in its infancy, starting-off on a low base means exponential opportunities in unlocking value. This mainly stems in the opportunity around digitising paper-intensive processes, having access to timely and real-time data, providing management with more effective decision-making tools and reducing the costs associated to service delivery (section **4.2**). E-Learning and virtual tools also play a critical role in knowledge access, training and skills development. These types of tools also reduce the time and cost of training Public Services Sector employees across all levels (section **5.3.2**). Furthermore, ET used in combination also have the ability to provide transparency, efficiency and empowerment to workers and civil society. From the consultations it was evident that very positive impacts on service delivery, interactions with citizens, better internal and external communication and planning, would lead to a better public services sector.

Threats presented by ET are not direct, with half of participants believing that ET would augment work and not necessarily lead to job losses. Other threats that are more prevalent and were voiced were around cybersecurity, technology mistrust and the unequal distribution of tools of the trade i.e. computers and data. In taking-up ET, some may be left behind, and thus a digital divide may occur. Some respondents and interviewees believe that ET would widen the rural-urban divide in accessing ET. Therefore, when implementing ET strategies, the distribution and ubiquity of the impact need to be studied across Provinces, as there are wide discrepancies in ET use.

ET are not the panacea; their use will not solve underlying socioeconomic issues and they may exacerbate these underlying issues if not implemented holistically. Trust in ET was also highlighted; whereby, Public Services Sector employees need to believe that the use of a specific ET is secure and that their confidence and trust in ET is reinforced. This also talks to change management and effective training.

Thus, in mitigating these threats that ET present, specifically around training in cybersecurity, privacy and protection of information, trusting in ET while having a wide access across rural and urban settings needs to be factored in.

Implications in terms of transversal skills/occupations required and ones that will be obsolete as a result of ET.

From the consultations, it was evident that majority of public employees in lower levels would require basic digital tools in understanding Cybersecurity and Basic Digital Platforms, whilst middle management would require understanding of ET that impact day-to-day operations i.e. Cloud Computing and IOT. Senior level management would require training in the use of Big Data analytics for strategic decision making .

The majority of public employees in lower levels would require Computer Literacy, Customer Service and Numeracy Skills, whilst middle management would require Communication and Interpersonal skills, Records Management and Technical skills in day-to-day operations. Senior level management would require skills around Financial Management, Leadership and Strategic Management.

In order to develop these competencies and skills there needs to be more awareness sessions on ET, online training, and mentoring through their respective managers. Furthermore, training needs to happen regularly through re-skilling and re-training. The use of increased funding towards relevant training and capacitation of employees.

The majority of respondents highlighted change management as being a key barrier that needs to be managed effectively. Some examples of change management workshops, courses, and conferences include:

- Reduce fear of the unknown associated with change,
- Mitigate risks associated with change,
- Manage communication - separate facts from fiction and fallacy, and
- Mindset shift to meet the demands brought to the fore by change.

Obsolete skills per occupation group will vary across functions, departments and ET use. It was implied that computer illiteracy would be a factor which would result in obsolescence. Furthermore, since work will be augmented through the use of ET, a new job specification would need to be developed and supported through training and

employee development. In this way, the job of the future, will allow current and new employees the ability to transition.

Implications ET will have on employment and recruitment in the Public Services Sector.

Respondents and interviewees believe that ET will have a positive impact on public service delivery, augmenting their work rather than replacing their tasks. Moreover, a new profile or persona is starting to emerge, especially when it comes to internships. The new public services sector employee, will require new personal aptitudes, mainly agility in their response to changing ET. Recruitment processes will need to adapt through new job specifications, technical and personal requirements, while concurrently upskilling existing employees – in order to leave no-one behind (section **5.3.4**). This is thus a dual track strategy focusing on internal employee development, while recruiting fresh, skilled and tuned-into ET internships and graduates (section **4.2)**.

How the Public Service need to react to reskilling and upskilling of today's workers to respond to the modifications brought about ET.

Public Service has started to react to changes in ET, specifically due to the COVID-19 pandemic accelerating ET use and acceptance (section **7**). Given the historic skills shortage in ICT and ET skills need to be developed (section **5.2**). Upskilling needs to be promoted across all levels and not solely at the Management level. Furthermore, having access to digital tools and e-Learning platforms is key in delivering training and content at lower costs. Thus, the basics need to be in place i.e. infrastructure (e.g. SITA and low bandwidth limiting reach). This is where the SETA plays a major role in guiding the curriculum development e.g. a mandatory cybersecurity, basic digital literacy or working in a digital way course for all levels. In driving the basics, we can also ascertain how deep the educational and skill gaps are, in intervene accordingly (section **5.3.1.**)

Reskilling speaks to completely changing roles or occupations. As the NSG outlined, if you have a capacity to learn and an opportunity, you are never too old to learn new things. In this way, the training speaks to all demographics, generations and institutional levels. More can be read in section **5.3.3.**

Mechanisms needed to ensure effective coordination and collaboration amongst all stakeholders (governments, educators, training providers, workers and employers in

order to better manage the transformative impact of ET on employment, skills and education).

Getting the basics right creates the momentum for a trained and developed pipeline of skilled and digital ready employees. This starts at the grass-roots educational levels, whereby, schools need to promote computer literacy and entrepreneurship. Furthermore, having a robust and reliant infrastructure which comprises of digital tools of the trade, broadband and data and electricity are needed to promote digital work and skills. Coordination between other SETAs is needed to amplify and target gaps. An example is PSETA working strongly and closely with MICTSETA. Furthermore, discussions with SITA, the DPSA and 4IR Commission (under the DCDT) need to be had to further strengthen and align goals and initiatives which unlock resources (section **6.1**.) Conversations need to be had with the DHET and TVET ecosystem, whereby, the diffusion of training can be applied. Lastly, many respondents and interviewees saw the rigidness in the QCTO system and qualification system as hindering technical skills. This speaks to more public-private e partnerships through vendor program certifications e.g. Microsoft Azure certification, SAP or IBM, being recognised in unlocking skills that are relevant, aligned to industry demand and talent, for the entire sector, including the Public Services Sector.

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11. Appendix

11.1. Additional Literature

The table below summarises key information relating to relevant literature to inform the Research Report and for further insights for the reader. The table indicates the key themes of each piece of literature and provides a short summary of the literature.

A detailed analysis of the literature was conducted, and the following core themes emerged:

Table 11-1: Literature Themes

Theme Identifier	Theme	Description
1	Institutional Framework	Government institutions, rules and regulations that shape technological development, service delivery through e-Government as well as e-Democracy or e-Governance models. This also considers country and international city best practices.
2	Technology and Innovation	The use of innovative ET including those of 4IR in aiding the delivery of e-service, e-Government and e-Democracy. Areas consider enabling technologies and ICT infrastructure to support the use and adoption of new technologies in Public Services Sector and the ability to foster innovation that have potential application in the Public Services Sector. These include big data, A.I, blockchain, IoT, smart devices, cloud computing, cybersecurity, drones and automation to name a few.
3	Human Capital	Current as well as the long-term labour force capabilities to cultivate the right skills and talent in the development of an ET proficient and 4IR-ready work force. This also speaks to human capital development, upskillment and traits.
4	Global Trade and Investment	e-Government as the driver for trade and investment. This theme considers the establishment of global trade and linkages to facilitate the exchange of products, knowledge and technology, and investment in infrastructure and

Theme Identifier	Theme	Description
		development enable production-related activities with e-Government being the catalyst.
5	Impact of Public Service Delivery	The impact of e-Government on the provision of public services, e-services, public goods and transversal efficiency and cost-savings.
6	Demand Environment	The response to government e-services at the local, National and international level and the changing needs of the citizen's, businesses, international governments cooperation

An outline of the identified literature was developed, and research publications were categorised thematically, as illustrated below.

Table 11-2: Additional Literature

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
1.	Enabling a sustainable Fourth Industrial Revolution: How G20 countries can create the conditions for ET to benefit people and the planet (Herweijer, et al., 2017)	This report looks at G20 nations (of which South Africa is a part of) and how they can embrace 4IR. The report suggests "the G20 should explore, and recommend, governance structures and policy mechanisms to ensure governments have the agility and ability to keep pace with the 4IR, and harness innovations that promise the greatest social and environmental returns."	✓	✓	✓			
2.	Agile Governance: Reimagining Policy-making in the Fourth Industrial Revolution (WEF, 2018)	This paper defines what "agile governance" is and what characterises it. The report proposes that an agile government is adaptive, human-centred, inclusive and sustainable	✓					

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
		in its policymaking-which includes extensive multi-stakeholder collaboration. The continual readiness to rapidly navigate change, proactively or reactively embrace change and learn from change, while contributing to actual or perceived end-user value, is looked at from a governance and ET perspective.						
3.	Government and the Public Services Sector have a role to play in 4IR (4IRSA, 2018)	The Fourth Industrial Revolution Partnership for SA (4IRSA) reports on the multi-stakeholder consultations the Partnership hosted and how various government departments are dealing with ET. The views presented are also informed by other key stakeholders such as training providers, research organisations and Private Sector companies.	✓				✓	
4.	The Era of Fourth Industrial Revolution: Challenges and Opportunities for the Public Service (PSA, 2019)	This report looks at 4IR from a worker perspective and seeks to understand how to mitigate potential job losses.		✓			✓	
5.	Public Services Sector monitoring and evaluation in the Fourth Industrial Revolution: Implications for Africa	Monitoring and evaluation (M&E) are increasingly important for service delivery as they lend themselves to improved governance and administration, accountability and knowledge	✓	✓	✓		✓	

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
	(Nalubega & Uwizeyimana, 2019)	generation. This research explores the place of ET in monitoring and evaluation in the Public Services Sector across Africa.						
6.	How governance is changing in the 4IR (Elmi & Davis, 2018)	This report looks at how traditional models of governance are being disrupted by ET.	✓					
7.	The Impact of the Fourth Industrial Revolution on Public Service Delivery (Badimo, 2018)	The author explores "how disruptive the fourth industrial revolution (4IR) is in shaping the way public services are structured, provisioned and consumed." The author also investigates "how the South African Public Services Sector is embracing this digital revolution in support of the National Development Plan 2030 (NDP)."	✓	✓			✓	
8.	How 4IR could boost public service delivery and rein in costs (Raphulu, 2019)	This piece of literature looks at the impact of ET and 4IR on service delivery and costs and suggests how 4IR could improve service delivery whilst reducing costs. It also looks at how this could be achieved, with the article looking at ways in removing bias from decision making and improving efficiency.		✓			✓	
9.	State of the art in the use of ET in the Public Services Sector - OECD Working Paper (Ubaldi, et al., 2019)	Presenting international case studies and benchmarks, the OECD looks at the opportunities and challenges for the use of ET in the Public Services Sector.	✓	✓		✓	✓	

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
		Based on the first results of the analysis of evidence collected in 20 countries, the paper offers insights on the strategies and practical examples on how governments are attempting to integrate ET in the Public Services Sector.						
10.	Being smart: ET and innovation in the Public Services Sector (Gil-Garcia, et al., 2014)	This paper explores the concept of the "smart government" and its role in "activities that creatively invest in emergent technologies coupled with innovative strategies to achieve more agile and resilient government structures and governance infrastructures."	✓	✓		✓		
11.	AI, analytics drive 4IR in the Public Services Sector (Doyle, 2020)	This literature reflects on industry experts' views on the Public Services Sector's readiness for embracing ET. The article also explores AI and analytics as ET.		✓				
12.	Tech Trends 2020: Peering through the lens of government (Deloitte, 2020)	In this paper Deloitte tracks sector trends and explores ET in 2020 and how governments can plan for the future.		✓				
13.	United nations E-Government Survey 2018 (The United Nations E-Government Survey, 2018)	The Survey measures e-Government effectiveness in the delivery of public services and identifies patterns in e-Government development and performance. The survey outlines the-Government development index	✓	✓	✓	✓	✓	✓

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
		along with global case studies in implementing e-Government solutions. While serving as a development tool for countries to learn from each other, identify areas of strength and challenges in e-Government and shape their policies and strategies in this area.						
14.	e-Government development index: Dynamics of the world and Russia's position (Borshchevskaia, 2018)	The scope of the study of the dynamics of innovation development indicators in different countries and regions of the world is currently expanding due to new global processes and challenges. This paper discusses one of the global indices characterizing to what degree countries are ready to implement and use E-Government services – E-Government Development Index (EGDI). In this paper, special attention is paid to the dynamics of Russia in the EGDI rating. The dynamics of Russia's position in 2010 – 2018 in the UN E-Government Survey, which showed a change in the growth in 2012 until a fall and stagnation in 2014 and 2016, and its causes are studied. The actions implemented by the Ministry of Telecom and Mass	✓			✓		✓

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
		Communications of the Russian Federation in 2012 – 2018 and the tasks the Ministry of Digital Development, Communications and Mass Media faced set in May 2018 are considered.						
15.	Best practices of the social innovations in the framework of the e-Government evolution. (Roblek et al, 2019)	This academic paper discusses how social dynamics have changed due to the advent or ET in governing systems at the micro (cities and regions) and macro (state and nations) levels. The paper also discusses the impact on the transformation from "classical" governance into the "smart governance".	✓				✓	✓
16.	Vision of future e-Government via new e-Government maturity model: Based on Korea's e-Government practices (Sangki, 2018)	This paper analyses the social paradigm shift caused by the new IT has brought the current highly-advanced information society following the industrial and information societies, and proposes a new e-Government development model called as "E-Government Maturity Model based on Socio-political Development" that incorporates the level of social maturity based on e-Democracy and the maturity level of civic society with statistic model. The new model classifies e-Government development into four stages: "Bureaucratic model", "Information	✓					✓

	Literature	Abstract	Themes					
			Institutional Framework	Technology and Innovation	Human Capital	Global Trade and Investment	Impact of Public Service Delivery	Demand Environment
		management model", "Participatory model", and "Governance model". So, this model will be expected to be generally expandable and applicable to e-Government cases of other countries.						
17.	Implementing successful G2B initiatives in the HKSAR An empirical evaluation of G2B websites (Kwok, 2014)	The aim of this study is to study the implementation of G2B initiatives for small- and medium-sized enterprises (SMEs) in Hong Kong, focusing on the underlying importance, benefits and challenges.	✓			✓	✓	✓
18.	How adoption is G2B model E-Government? (Dong & Songtao Han, 2010)	With the development of information technology, E-Government has become a key indicator to measure the evaluation of government performance reform in the world. In this research, we took Xi'an Municipal's G2B model E-Government for example to survey how wildly adoption of G2B model E-Government in society, and explore what factors influence the enterprises' intention of using G2B mode E-Government.	✓				✓	✓
19.	Digital agenda 2020 for Estonia Updated 2018 (summary)	This is a summary of Estonia's National AI Strategy which provides a case study on how A.I can be implemented to achieve	✓	✓	✓	✓	✓	✓

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	(Goverenment of the Repulic of Estonia, 2018)	country competitiveness in public (e-services) and private enterprises.						
20.	Australian Digital Transformation Strategy (Digital Transformation Agency, 2020)	The Australian Digital Transformation Agency encompassing representatives from different agencies is at the forefront of evaluating potential use of ET and scaling adoption of digital interfaces across government. A roadmap of initiatives and objectives has been created to improve government services that are simple, clear and fast. These objectives can be used in aiding e-Government milestones and competencies with a focus on National AI Ethics Framework, Artificial Intelligence Roadmap and National Blockchain Roadmap are also outlined.	✓	✓		✓	✓	✓
21.	E-Government systems in South Africa: An infoculture perspective e-Government systems in South Africa: An info-culture perspective (Singh & Travica, 2018)	The purpose of this study was to investigate challenges surrounding e-Government systems in South Africa and their origins. Based on interviews with senior man-agers/senior state administrators as the key method and on qualitative data analysis, challenges were identified within the cultural environment of the senior managers, their positioning in relation to e-Government	✓		✓		✓	

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		systems, organisational processes, and in the policy domain. A specialized cultural analysis based on the informing culture framework was applied in order to deepen understanding of the challenges' origins. The contributions of this research are in advancing theorizing on e-Government and in helping the senior managers/senior state administrators to develop a better understanding of the cultural environment that they are expected to work in.						
22.	From government to e-Government: a transition model (Davison, Wagner & Ma, 2005)	The purpose of this paper is to develop a model that can explain the "government to e-Government" transition process. It reviews the literature on and practice of e-Government, as well as the related literature of strategic alignment and maturity models for technology adoption. It offers evidence for the model's validity through case-type material from the Web sites of e-Governments worldwide. Six transition paths can be identified, four of which are more likely to result in effective e-Government transition. The transition from government to e-Government appears to be inevitable for many	✓				✓	✓

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		governments around the world. This development is in line with the focus on new public management, which tries promote an agenda of citizen-centric and accountable government, and views the citizen in part as a customer.						
23.	Societal Needs Analysis and ET in the Public Services Sector (SONNETS) (SONNETS, 2017)	SONNETS project aims to fully exploit the benefits of ICTs to help the public sector meet emerging societal needs. With this objective in mind, SONNETS has designed a methodological framework that will accelerate the implementation activities and modernization of the Public Services Sector through the identification and analysis of ET that hold the potential to transform the Public Services Sector into a technology leader and innovation carrier, addressing, at the same time, the most pressing needs of the citizenship.	✓	✓			✓	✓
24.	Quality in e-Government services: A proposal of dimensions from the perspective of Public	The main objective of the work is to identify the key factors that must be considered by the Government when designing the web service portals used by its employees. To achieve these			✓		✓	

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	Services Sector employees (Soledad & Javier, 2018)	objectives, empirical work was then carried out to collect primary information, using the Delphi method and obtaining the opinion of 31 specialists who are experts in quality management in the university environment. The results of the study show that four dimensions must be considered to measure the quality of electronic services. These dimensions are: quality of information, technical efficiency, privacy and communication with the employee.						
25.	G2C Model with Data Analytics Implementation for an Effective Disaster Prevention and Preparedness Government Program (Delluza & Caballero, 2018)	Integrating ICT services and its application in disaster management contributes greatly as a tool for sustainable development that offers faster, cheaper, easy to use, and shortened process of the public service. In this study, a Government-to-Citizen (G2C) application was developed and tested through citizen-centric interest cluster for disaster prevention and preparedness. This enables Local Government Units (LGUs) to shape an enhanced disaster resilient and disaster prepared communities.	✓				✓	✓
26.	A Conceptual Model for G2G Relationships	This paper proposes a conceptual model that groups different factors	✓				✓	

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	(Hamza, et al., 2011)	that can influence relationships between government agencies. The model is based on a systematic literature review of published papers related to Government-to-Government (G2G) relationships. Through analysis of selected papers, we identified, classified, and organized factors that may impact relationships between government agencies. The proposed model may help government managers to improve their G2G policies.						
27.	The benchmarking of the government to Employee (g2e) technology development: Theoretical aspects of the model Construction (Baležentis & Paražinskaitė, 2013)	The paper discusses the important topic of e-Government research—design, development and usage of information and communication technologies for human resource management in the Public Services Sector and to formulate theoretical benchmarks for development of the government to employee (G2E) model.	✓				✓	
28.	E-Government Diffusion, Policy, and Impact: Advanced Issues and Practices (Khosrow-Pour, 2009)	As governmental entities face accelerating public demand for electronic services and the internal need to utilize technology to achieve superior outcomes and operational efficiency, traditional	✓	✓	✓	✓	✓	✓

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		techniques and tools are radically reshaping and evolving into innovative electronic methods of conducting governmental activities. E-Government Diffusion, Policy, and Impact: Advanced Issues and Practices sheds light on how e-Government technologies are shaping today's knowledge society from the ground roots of the citizen experience to the supreme level of policy and decision making. With chapters providing insights into such critical topics as public service delivery, technological diffusion, and e-readiness, this publication offers researchers, students, policy makers, and practitioners a quality depiction of worldwide social practice and how advancements within the realm of technology will affect all corners of the globe.						
29.	Synthesizing e-Government stage models – a meta-synthesis based on meta-ethnography approach (Siau & Long, 2005)	The growing interest in e-Government raises the question of stages in e-Government development. A few stage models for e-Government have been proposed. Without a common e-Government stage model, different research in e-Government may be based on different stage models.	✓				✓	

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		This presents a difficulty in comparing and understanding different research results. In this research, we synthesize the existing e-Government stage models so that there is a common frame of reference for researchers and practitioners in the area. The synthesized e-Government stage model presents a road map for practitioners to follow in their e-Government projects						
30.	e-Services, including e-Government (Department of Communications, n.d.)	This summary outlines the South African e-services and e-Government landscape as well as some implemented e-services and e-Government use-cases	✓					
31.	Core skills for Public Services Sector Innovation (OECD, 2017)	This report by the OECD looks at skills needed to promote and enable Public Services Sector innovation. The first of these calls are about the skills and capabilities of officials.	✓		✓			
32.	Digital Skills Toolkit (ITU, 2018)	This toolkit provides stakeholders with guidance on developing a digital skills strategy. It is intended for policymakers, along with partners in the Private Sector, non-governmental organisations, and academia. Its overarching aim is to facilitate the development of a	✓		✓			

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		comprehensive digital skills strategy at country level. It is also possible to use this guide to focus on selected priorities that require a fresh approach.						
33.	The journey to government's digital transformation (Deloitte University Press, 2015)	A Deloitte Digital global survey that looks into governments readiness and maturity towards digital transformation.	✓		✓			
34.	National e-strategy (DTPS, 2017)	The National e-Strategy builds on various policies within the ICT and related sectors amongst them the Integrated ICT Policy White Paper and the ICT RDI Roadmap and the Industrial Policy Action Plan. It seeks to ensure a coordinated approach to the implementation of various initiatives arising from these and other government policies. The National e-Strategy should therefore be read together with these and other policies to establish an ecosystem as the basis of the digital society	✓		✓			
35.	Skills for a High Performing Civil Service	This report addresses both sides of this challenge by proposing a framework through which OECD countries can	✓		✓			

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	(OECD Public Governance Reviews, 2016)	begin to assess the skills they presently have or gaps that may exist. Then, through the use of OECD data, the report identifies promising trends and innovations in civil service management that can help set the right strategy to improve employment policies. This report was prepared by the OECD Directorate for Public Governance. It is based upon a 2016 survey by the OECD Public Employment and Management Working Party and its related work on skills, competencies and performance.						
36.	Preparing tomorrow's workforce for the Fourth Industrial Revolution For business: A framework for action (Deloitte, 2018)	This report highlights opportunities for the business community to contribute to the development and growth of the future workforce, focusing on suggested best practices to reach and support youth globally.	✓		✓			
37.	Accenture smart nation workforce (Accenture, 2017)	A summary PowerPoint of Singapore as a standard-setter for ET in the Public Services Sector.		✓			✓	
38.	The Paradox of ET in Playing Fundamental Role on Administration Employee's Roles and Responsibilities (Mogale, et al., 2018)	This article aims to put forward the imperatives of ET in playing fundamental role on administration work effectiveness and efficiency. The nature of office work has changed through time					✓	✓

Literature	Abstract	Themes					
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		due to the emergence of new technologies that are adopted and implemented in the government departments. The ET are the heartbeat of any organisation and simultaneously they are the structure and thread holding it all together. The study argues that the influx of ET increases the relationship with stakeholders and shareholders, responsiveness, transparency and accessibility of quality service delivery. The study concludes that with the emergence of technologies, it is important for government departments to initiate new technologies in the departments to faster transactions, provide excellent service delivery to citizens of South Africa and as well as improving mass communication.					
39.	Policy Options Framework for the Fourth Industrial Revolution of South Africa (Human Sciences Research Council, 2018)	The Policy Framework maps and explores the scope of possible policy responses to the 4IR. The Framework summarises and organises the key ideas and discussions emerging from the Dialogue conference, and therefore represents a synthesis of the collective insights of the 36 conference speakers, the 12	✓		✓			

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		members of the steering committee, the supporting teams from the DST, HSRC, and EU Delegation to South Africa, and the over 100 conference delegates over three days of intensive discussion and debate.						
40.	Towards a Reskilling Revolution- A Future of Jobs for All (WEF Inisght Report, 2018)	Towards a Reskilling Revolution: A Future of Jobs for All introduces a new approach to identifying reskilling and job transition opportunities, including those that might not be immediately apparent. Using big data analysis of online job postings, the methodology in this report demonstrates the power of a data-driven approach to discover reskilling pathways and job transition opportunities. The methodology can be used to inform the actions of individual workers, policy-makers and companies. It can be applied to a variety of taxonomies of job requirements and sources of data. In assessing reskilling pathways and job transition opportunities in such detail and at such scale, we aim to move the debate on the future of work to new—and practical—territory. This report is a beginning. In subsequent publications, the	✓		✓			

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	methodology will be extended to include additional perspectives and geographies and applied in collaboration with government and business stakeholders to support workers. We also hope it inspires similar efforts to think practically yet holistically about managing reskilling, upskilling and job transitions.						

Keeping the above in mind, regarding the ET context, definitions and ideals, the next sections considers feedback from primary research from interview consultations and electronic-surveys. This research will be highlighting areas of development and key trends and impacts of the use of ET, training and capacitation of Public Services Sector workers.

These sections, should be directly juxta-positioned in your mind, to the case studies and literature, in attaining the ideal state, and the current state, so that gaps can be amplified and identified in order to bridge these deficiencies and target various technology types, skill traits and infrastructural barriers in implementing ET successfully within the Public Services Sector.

APPROVAL OF RESEARCH REPORT BY CEO

Research conducted by RedFlank Solutions on behalf of the Public Service Sector Education and Training Authority (PSETA)

APPROVAL OF RESEARCH REPORT BY ACEO	
Recommendation(s)	Approved/~~Not Approved~~
Comments: **Report approved**	
Signature	
Name and surname	**Ms Bontle Lerumo**
Date	**30 September 2020**

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