

# The South African public service and the Fourth Industrial Revolution



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**Background:** With technology now being embedded in almost every business, it can be argued that the advancement in technologies has brought the world at the cusp of the Fourth Industrial Revolution (4IR). This article, focuses on developing countries, with specific reference to South Africa. Competition in the provision of goods and services, as well as constant changes in the preferences of customers, has resulted in the need for the public service to come up with novel skills and strategies in the use of modern technologies aimed at improving service delivery.

**Aim:** Firstly, the article identifies the critical drivers for advanced technological changes, and the opportunities and challenges of embracing the 4IR. Secondly, it makes suggestions on how South Africa's public service can enhance its preparedness to embrace technological changes in order to harness the opportunities and mitigate the impact of the 4IR.

**Methods:** The study followed a qualitative approach, using secondary documents, analysing and providing insight on embracing the 4IR in the public service.

**Results:** This study established that South Africa is amongst the countries that have not yet fully embraced the digital transformation of the economy. The public service should utilise technology to help solve service delivery challenges. Employees need to possess relevant skills to enhance service delivery.

**Conclusion:** The article concludes that comprehensive and robust education, including training and development programmes suitable for the public service, needs to be developed, in keeping with the 4IR's requisite skill requirements. The government needs to align its human-resource policies to the 4IR.

**Keywords:** Fourth Industrial Revolution; public service; training and development; artificial intelligence; robots; cyber security.

## Introduction

In this article, it is argued that South Africa's public service employees require multiple skills, amongst others, emotional intelligence, creativity and problem-solving skills in order to meet the demands of the Fourth Industrial Revolution (4IR). The 4IR can be described as the advent of 'cyber-physical systems' involving entirely new proficiencies for people and machines, representing entirely new ways in which technology becomes embedded within societies (Davis 2016). The 4IR signals the innovative and digital transformation of entire systems of not only production but also management and administration. Sutherland (2020:233) describes the 4IR as an 'umbrella' term for three-dimensional (3D) printing, artificial intelligence (AI), big data, internet of things (IoT) and robotics. This new technological change is marked by a combination of technologies that blur the lines between the physical, digital, biological and neuro-technological spheres (Xu, David & Kim 2018:91), thereby impacting skills stability in the public service.

In that regard, the sudden upsurge in the use of advanced technologies has the potential to fundamentally alter how people live, work and think within our communities. The public service is about delivering public services and products to the society and in ways that are operationally convenient and efficient. Subsequently, the technology is re-defining the public service workforce with a combination of intelligent technology and human ingenuity.

Urgent and targeted action needs to be undertaken by governments such as South Africa in order to secure advanced technologies and thereafter establish a workforce equipped with the skills to cater for the changing economic dynamics influenced by the 4IR. Jarbandhan (2017:63) concluded that 'the ability of government systems and public authorities to adapt will determine their survival'.

The World Economic Forum (2016) projected that innovation brought about by the digital transformation would cause massive job losses. The public service is lagging behind in the adoption of technology, especially digitalisation because of its social obligation to address the triple challenges of poverty, inequality and unemployment, currently hovering around 30% (Manda & Backhouse 2017:8). As a result, there is a need to conduct research on what the public service should do to enhance its preparedness to fully embrace digitalisation of the work environment. The existing body of knowledge highlights the challenges, prospects and opportunities of the 4IR in developed countries. More research studies are needed in the context of developing countries such as South Africa.

This article, therefore, seeks to address the following research questions:

- What are the critical drivers for technological change?
- What can be done by South Africa's public service to enhance its preparedness to embrace the 4IR? and
- What are the opportunities and challenges of embracing the 4IR?

As already alluded to, this study followed a qualitative desktop approach that focused on secondary sources of information to get insights into embracing the 4IR in the South African public service. However, to mitigate the limitation in reliance to secondary information, data from previous empirical studies were also consulted to establish balanced viewpoints regarding embracing the 4IR.

The article makes two major contributions to the existing body of knowledge. Firstly, it identifies critical human resource training and development issues within a developing country. Secondly, it makes suggestions on how to harness opportunities in mitigating the impact of the 4IR on South Africa's public service.

In terms of structure, following the introduction is the research methodology adopted for this study. This is followed by the background and context of the 4IR. Critical drivers for change follow next and thereafter, the importance of training and development of human resources for the 4IR is examined. The next section explores the opportunities and challenges presented by the 4IR. Thereafter, recommendations and a conclusion are provided.

## Research methodology

The study utilised a qualitative research methodology, underpinned by a case study design and document analysis. Qualitative research is mainly exploratory, that is, it is used to develop an understanding of the underlying causes, beliefs and motives that help identify and explain the nature of social phenomena with little interaction regarding the natural environment (Miles & Huberman 1994:6). A case study design explores the current life events extensively in the situational analysis of incidents and their relationships

(Zaidah 2007:2). South Africa has embraced the 4IR and has been used as a case study amongst African countries that have embraced digital transformation.

Documents help the investigator to gather enough information from different sources, thus saving on the resources and time constraints of primary data collection methods, such as questionnaires and surveys (Doolan & Froelicher 2009:13). Government policies influencing digital transformation and international reports have been used as primary sources of data. Secondary sources of data, such as books and academic journal articles, have been consulted and evaluated for context, meaning and information acquisition about the challenges encountered in assimilating the 4IR principles in the South African public service. Analysis of data obtained through critical readings, previous empirical studies of researchers and secondary sources informed the strategies recommended for implementation to enhance the assimilation of the 4IR in the South African public service.

The documents were classified into three categories. Firstly, policy documents analyse the 4IR legislation and policies pertaining to South Africa. Secondly, progress documents gather information on the execution of the 4IR in the South African public service. Thirdly, the 4IR reports, books, journals and newspaper articles are assessed to gather information on the successes and challenges facing the adoption of the 4IR in the South African public service. The document analysis involved the collection of information from sentences, quotes and extracts. Using content analysis, the information was grouped into major themes related to the main questions. The following section presents the 4IR background and contextualisation.

## The Fourth Industrial Revolution – Background and context

Schwab (2016:6) notes that the word 'revolution' signifies a sudden and radical change. The First Industrial Revolution started in 1760 and was characterised by its own distinctive human resource requirements, as did the other industrial revolutions (Xu et al. 2018:90). According to Schwab (2016:6), revolutions are not a new phenomenon in the history of humankind; they have occurred when new technologies are developed and perceived to have the potential to trigger abrupt and profound changes in economic systems and social structures.

During the First Industrial Revolution, water and steam were the main sources of power for the production of goods and services. From the 1760s, there was an improvement in the people's purchasing power, which has been attributed to the rise in the demand for goods and services. This is generally regarded as the first wave and was characterised by the shift from rural-agrarian to urban-mechanised production (Minnaar & Bekker 2005:39; Sutherland 2020:236; Xu et al. 2018:90). According to Xu et al. (2018:90), during this period,

textile and steel became the dominant industries in terms of employment. When the Second Industrial Revolution began in 1900, communication improved and the distribution of electricity also expanded. The Second Revolution was characterised by rapid industrialisation and is regarded as the second wave, symbolised by the assembly line (Minnaar & Bekker 2005:39).

In the 1960s, the Third Industrial Revolution saw societal focus shifting towards significant advances in information technology (Sutherland 2020:236). Regarded as the third wave, the Third Industrial Revolution was symbolised by the computer (Minnaar & Bekker 2005:39). With this wave, the world gradually evolved into an information-based system of wealth (Minnaar & Bekker 2005:39). During this period, digital capabilities spread to billions of people across the globe as a result of key innovations in areas such as mobile telecommunications. The main emphasis during the Third Industrial Revolution was on the implementation of electronics and information technology to automate production (Xu et al. 2018:90). Suffice it to say that the Third Industrial Revolution heralded the emergence of the 4IR.

As already highlighted, the 4IR is characterised by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres. This revolution is evolving at an exponential pace and disrupting all types of industries (World Economic Forum 2016). Based on the above observation, Jarbandhan (2017:61) argues that the 4IR has the potential to become one of the most disruptive and transformative shifts in history.

Minnaar and Bekker (2005) describe the 4IR as an 'Age of Chaos'. During this era, there will be many unintended consequences and counter-intuitive outcomes, purely because of the pace of constant change (Minnaar & Bekker 2005:43). The World Economic Forum (2016) predicted that soon we will be distinguishing between 'innovation-rich' and 'innovation-poor' countries; hence, there is a need to focus on technological development. Against this background, this technological wave has the potential to improve the delivery of public services and/or goods in countries that have fully embraced it; however, the transition is going to be tumultuous (Kaplan 2015).

Shava and Hofisi (2017:203) project that the 4IR is likely to shed approximately five million jobs worldwide, thereby exposing people to potential loss of jobs. According to Arntz, Gregory and Zierahn (2016), on an average, across the 21 OECD countries, 9% of jobs are automatable. The emergence of automation is a global concern to both developing and developed countries. Governments are set to experience the effects of these changes if nothing is done to mitigate the impact of the revolution. The potential loss of jobs as a result of automation is the central concern of governments about the 4IR (Sutherland 2020:235), as it has a detrimental effect on people's livelihoods.

The anxiety caused by the revolution is unprecedented and requires the public service to be proactive by revisiting the existing human-resource training and development programmes so that employees are capacitated to meet the demands of the 4IR (Nhede 2018:202; Shava & Hofisi 2017:213). According to Zervoudi (2020:5), the poor and non-skilled workers may be plunged into even deeper deprivation with the rise of the digital era.

The World Economic Forum (2017b) recommends prioritisation of training and re-training of human resource in order to enable the workforce to remain relevant to the needs of the ever-changing work environment. The 4IR requires a new breed of workers who are skilled, innovative and technology savvy (Manda & Backhouse 2017:3). Thus, the public service should have in its midst employees with the requisite skills to match the latest technological transformation (Naude 2017), which would enable them not only to harness the opportunities but also to anticipate threats posed by the 4IR. Manda and Backhouse (2017:1) argue that digital readiness helps government to leverage opportunities and address the challenges of digital transformation.

The current industrial stage focuses entirely on new capabilities for people and machines. Balkaran (2017:1) observed that the new rubric of digital transformation is denoted by cyber-physical systems. The public now uses smart objects for recording information and communicating flexibly in this virtual world characterised by the use of the internet and social media platforms. However, according to Balkaran (2017:1), it is alleged that some governments and human resource practitioners are apprehensive over the perceived replacement of human beings with machines which has the potential to make some employees redundant. The World Economic Forum (2017a) predicted that 41% of all work activities in South Africa are susceptible to automation, as are 44% in Ethiopia, 46% in Nigeria and 52% in Kenya. Thus, the region should brace itself for unprecedented job losses. The use of machinery to perform some of the tasks used to be carried out by human beings now requires that people should be multi-skilled in order to remain relevant in some areas of expertise. The digital world has seen a shift towards collaboration between human beings and machines in order for people to adapt to automation. Under such circumstances, production failures are likely to be minimised as machines will be able to detect faults automatically.

According to Stewart, De and Cole (2015), a positive narrative about technology and progress has dominated history. However, from time to time, this narrative has been punctuated by fears about the job-destroying effects of technology. As the global transformation of work unfolds in Africa, policymakers, business leaders and workers should be prepared to proactively manage this period of transition (World Economic Forum 2017a).

The adoption of new technology, however, leads to potential job losses or redundancy (Prisecaru 2016; Sutherland 2020:235).

The perception is, thus, that only jobs that have a ‘human touch’ will survive the 4IR. The adoption of new technology to increase supply or productivity has remained core to the theories of industrialisation and modernisation. The theories support the need for continuous improvement in technology to achieve market growth and remain competitive in this global age. There is a need for business to adopt new efficient and specialised techniques to increase production levels or product quality. This shows that skill development plays an important part in increasing the output, as well as meeting demands. This article argues that the public service should strive to align employees’ skills to new technology, or to reduce redundancy by adopting relevant training and development programmes. It is also important to prepare educators for the new technology. They should know how to use it and how to infuse it with locally relevant content. The World Economic Forum (2017a) observed that ‘education and work in sub-Saharan Africa will determine the livelihoods of nearly a billion people in the region, and drive growth and development for generations to come’.

## Critical drivers for technological change

The need for new technology has, to a certain extent, been influenced by demographic and socio-economic shifts from one epoch to the other. Thus, change is irresistible because of the changing nature of work. Stewart et al. (2015) observed that ‘while change is the driver for prosperity, it is also profoundly unsettling’. As a result, some countries are hesitant and slow in embracing the popularised 4IR. The rapid changes accelerated by the 4IR challenge legislators to urgently adopt and be innovative enough to embrace technologies (Shava & Hofisi 2017:208).

Changes in society’s preferences of goods and/or services also contribute to digital transformation. Rising competition for markets compels organisations to find new methods of improving the quality of their services and/or products. Technological advancement has become an important feature in organisations fighting to meet demands (Stewart et al. 2015). Online platforms such as the internet are being used for advertising and marketing of goods and/or services. Thus, technology has now become an important facet of globalisation, which presents both opportunities and risks. It can be argued that globalisation has contributed to the transformation of technologies (though not without challenges), as organisations seek to remain relevant and competitive in the global environment.

According to Talwar and Harnock (2010), the common indicators of the 4IR believed to be the drivers of change include, amongst others, advances in computing power and big data, new energy supplies, the sharing economy and peer-to-peer platforms and AI. The 21<sup>st</sup> century has observed persistent changes in technology because of the need for profit maximisation. Organisations aim to maximise profits; hence, advancing technology improves the quality of goods

and services while reducing costs. In human resource management, the development has brought about challenges that affect employee duties and redundancy has become a common problem.

The need for new technology has, to a certain extent, been influenced by demographic and socio-economic shifts from one epoch to another. The changing work environments and the rise of geopolitical and new consumer concerns about ethical and privacy issues were identified as some of the drivers to change. Improving the quality of goods and/or services has largely been influenced by the changing demographic and socio-economic expectations of the public in line with the technological transformations. The changing values of consumers and growing consumer demands have fuelled the need for technological advancement, resulting in changes in business models (World Economic Forum 2016). Governments have been pursuing the optimal use of new technology in order to meet the demands of the people for better life. As new prospects are being created, it can be argued that technological changes are seemingly making positive claims. Environmental and social pressures need to be scrutinised. According to the World Economic Forum (2016), it is important for governments to embrace automation in order to reduce emissions of gases. This will be in line with global policies which are aimed at reducing environmental degradation and pollution.

Although the South African public service does not have a specific policy governing the 4IR, there are a few policies influencing digital transformation. Thus, drafting a specific and comprehensive policy on the 4IR to guide the government is essential. The main policies influencing digital transformation in South Africa are outlined in Table 1.

The different policies and strategies outlined in Table 1 are an indication that the South African government is embracing the 4IR and would like to ensure that advances in technology benefit all people, not just a few. However, these policies and strategies are still disjointed, and there is a need to integrate them. Digital transformation of the public service should be

**TABLE 1:** Main policies influencing digital transformation in South Africa.

Policy or strategy document	Relevance
Electronic government: The digital future: a public service IT policy framework (2001)	Spelled out the e-government vision, and defined clearly how progress is to be measured and set priorities for ICT in government.
National Development Plan (2012)	A long-term plan for development, which provides a broad strategic framework to guide key choices and actions, including inclusive digital transformation.
Public Service Corporate Governance of ICT policy (2012)	To strengthen governance of ICT as an important resource in the public service.
Cyber-Security Policy Framework (2015)	To strengthen security and improve trust in the cyber environment by providing a safe and secured space for society, business and government to thrive.
National Integrated ICT Policy White Paper (2016)	Outlines the overarching policy framework for the transformation of South Africa into an inclusive and innovative digital and knowledge society.

Source: Manda, M.I. & Backhouse, J., 2017, ‘Digital transformation for inclusive growth in South Africa: Challenges and opportunities in the 4<sup>th</sup> industrial revolution’, paper presented at the African Conference on Information Systems and Technology, Cape Town, South Africa, 10–11th July.

ICT, information and communication technologies.

anchored by an e-government framework; hence, there is a need to build digital skills in the public service. With the emergence of the 4IR, capacitating the public service through digital access has become more urgent than ever before. As a result of technological transformation, in 2018, President Cyril Ramaphosa appointed a presidential commission to develop the country's national strategy plan to deal with the 4IR, which is being coordinated by the Department of Telecommunications Services (Lekhanya 2019:3).

## Public service training and development and the Fourth Industrial Revolution

In the public service, human resources are a critical element in enhancing public service delivery. According to Van der Westhuizen and Wessels (eds. 2013:1), principally the manner in which the public service operates is influenced by the quality of the human resources at its disposal and the way in which the knowledge and skills of government employees are developed and managed. Human resource training and development is a strategy that has been used over the years for acquiring skills relevant to any new realities of public-service delivery.

Van der Westhuizen and Wessels (eds. 2013:321) state that public human resource management as a system should ensure that public officials are sufficiently capacitated and competent to understand and respond effectively to new realities induced by the ever-changing milieu. On-the-job as well as off-the-job training methods have been employed, depending on the nature of the training requirements. The nature of work and complexity of the workplace are evolving in line with the successive industrial revolutions.

The likelihood of skills instability in South Africa is quite high, and considering the emerging innovations and disruptive trends resulting from advanced technologies, there is a need for people to urgently acquire essential skills for the digital age. The skills instability would stem from the fact that many jobs are rapidly evolving to use digital technologies more intensively (World Economic Forum 2017a). South Africa is already characterised by high unemployment, high inequality, poverty and low skills. The 4IR ushered in the digital era in which issues of unemployment and employability are becoming a serious social problem. According to Zervoudi (2020:3), the 4IR affects employees differently; routine jobs with multiple tasks requiring automation are the most affected, whilst the risk is lower for those jobs involving high communicative and cognitive skills. In South Africa, embracing the 4IR needs adequate consultations between the government and labour unions, without which current fears of losing jobs may lead to instability in the public service.

It should be noted that the increase in the use of e-government and digital government services poses a threat to both governments and technology-driven societies. Electronic

government information accessible on various e-platforms can be exposed to cyber criminals and cyber terrorists. According to Subban and Jarbandhan (2019:135), the governance of cyber-centric citizens and cyber security now require more attention than ever before given that numerous cyberattacks have been launched against advanced information societies.

Cyber security is one of the fundamental aspects of the technology revolution era that governments should regulate through relevant policies. Governments have a responsibility to ensure that citizens are protected from cyber-interference and hacking of sensitive information. In view of this challenge, further training and development of public service employees to enable them to deal with cyber security governance would be a necessity (Subban & Jarbandhan 2019:154).

The design of the public service for the age of the 4IR should show greater sensitivity to the labour factor, the social utility of the public service and the need to preserve jobs in the public service as a national imperative. As the fourth generation of industrialisation requires employees who are competent and multi-skilled, there are fears that digitalisation will plunge the poor and non-skilled into deeper deprivation, which will worsen existing inequalities (Schwab 2016). The use of robots to perform routine tasks has been gaining momentum over the years, an indication that robots have the capacity to do much of what professionals do today (Susskind & Susskind 2015). Since robots or big data carry out multiple tasks, there is a need for employees to acquire more skills that enable adaptability to the new reality. According to Xu et al. (2018:93), the scarcest and most valuable resource during the 4IR will be neither ordinary labour nor ordinary capital; rather it will be those people who can create new ideas and innovations.

South Africa has a significant skills shortage emanating from the failings of the education system, which limits the supply of managers and workers needed for the 4IR (Sutherland 2020:233). For employees to remain relevant with the prevailing way of life, they are required to continuously improve their capabilities through education, training and development. This will enable them to align their skills with new technology. Employees need to have complex problem-solving skills for them to be able to identify complex problems and review related information, to develop, evaluate options and implement solutions (Autor, Levy & Murnane 2003). Zervoudi (2020:15) argues that as robots are capable of taking over some tasks performed by human beings, there is a need for employees to exploit their comparative advantages such as their ability to diagnose a problem and manage complex situations. Their cognitive skills and their ability to think out-of-the-box are essential capabilities for the 4IR. Creativity and innovation are also very important in this 4IR, given that there are high levels of competition in the provision of goods and services. In addition to acquiring these complex skills, the public service needs training in areas that are difficult to

automate, such as people management, judgement and decision-making, negotiation and cognitive flexibility. According to the 2016 World Economic Forum report, these are some of the critical skills one would need to secure jobs in the digital era.

Some degree of differentiation of products is necessary to enable organisations to remain competitive. There is an increased demand for human resources with competencies that are irreplaceable by automated technologies. Examples of such competencies include innovation, creativity, sensitivity and social skills. However, it should be noted that capability without the flexibility to cope with the rapid changes is not good enough. Schwab (2016) argued that although the 4IR has the potential to 'robotize' humanity, there are a few parts of human nature which robots cannot perform, such as creativity, empathy and stewardship. The public service has a far more important role to play in the uncertain future of the 4IR as a source of employment as well as to deliver public services, especially in view of the increasing demand as a result of rising joblessness that might be exacerbated by new technologies.

Essentially, in South Africa, human resource training and development are of paramount importance as these prepare the public service to deal with the management challenges of the digital society. One of the greatest challenges for the public service is to have people who have the requisite skills that match the latest technologies (Shava & Hofisi 2017:204).

As a result of the rapid evolution of the job market, reliance on narrow expertise is unlikely going to sustain long-term careers (World Economic Forum 2017b). Critical in training and development is content and how it is delivered, including the integration of information and communication technologies (ICT) in public administration. Dassah (2014:360) is of the opinion that ICT should be viewed as an enabler for economic growth and development.

Education, and training and development should be of high quality and aimed at enhancing employability. Global competitiveness and responsiveness to new challenges arising from the evolving public management environment can be achieved through relevant training. The World Economic Forum (2017a) reported that employers across sub-Saharan Africa have already identified inadequately skilled workforces as the major challenge to their businesses, including 41% of all firms in Tanzania, 30% in Kenya, 9% in South Africa and 6% in Nigeria.

The public service is the avenue through which a government can provide goods and services to the citizenry effectively and efficiently. Use of advanced technology enhances the quality and quantity of services and goods provided. Dassah (2014:361) considers e-education to be the foundation for new knowledge and one of the drivers for wider ICT usage in contemporary societies. In order for the public service to cope with the sophisticated and constant changes in the

digital environment, training and retraining of public officials are imperative (Dassah 2014; World Economic Forum 2016). However, it is important to note that training people on new technology and automation requires a substantial funding, which governments in developing countries such as South Africa may not be able to afford.

## Opportunities and challenges for the public service

The technological wave of the 4IR has brought hope to the public in the form of increased efficiency and effectiveness in the provision of goods and services. Although the benefits of the 4IR are numerous, in many cases, they are unknown, because they are a result of the emerging advances in science and technology. With automation, the quality of service delivery is set to improve. Technology makes accurate data become easily available and accessible. It enables service providers to connect with consumers through the Internet. Information sharing between government departments is enhanced, as is coordination. The 4IR creates opportunities for global contacts and networking.

Availability and accessibility of data, as well as information sharing, lead to informed decision-making. Embracing technology results in a public service that is flexible and not bureaucratic. Therefore, the adoption of the 4IR leads to increased productivity and consumer expectations being met (World Economic Forum 2016). In government departments, the implementation of e-government has also led to improved service delivery. It can be argued that the 4IR is not only leading to the improvement of service delivery, but to some extent, managers are now more able to predict improvements in productivity than before. Whilst there are many positives about automation, there are also some negative aspects of digitisation. Xu et al. (2018:92) noted that whilst there are many benefits of the 4IR, there are also challenges that lie ahead.

Information is vital for the survival of any organisation; hence governments want to tread carefully, fearing that they may lose control over the information. The breaching of sensitive information is rampant and South Africa has not been insulated from these attacks (Subban & Jarbandhan 2019:134). From a legal perspective, the greatest fear is that of violating the right to privacy. Kernaghan (2014) argued that in pursuing robotics, several ethical issues need to be considered. The adoption of advanced technologies has given rise to cyber-war, thereby posing threats to peace and security. The 4IR can lead to the proliferation of cyber breaches, terrorism and abuse of information by criminal organisations (Kernaghan 2014). Embracing the 4IR is causing great anxiety over potential job losses to electrical devices. However, it is important to note that many industries in developing countries rely heavily on manual labour, which ensures that there are job opportunities for many people.

Although robots may have AI, they have no sense of emotions or conscience. They cannot think for themselves. Thus, it can

be argued that robots cannot replace human-to-human interaction (Colvin 2015). African countries are at the cusp of the 4IR, and it is perceived that this will fundamentally disrupt and transform the way in which people work (Balkaran 2017:1). However, the adoption of machinery or robots enables organisations to produce new innovative products. Though the 4IR is perceived to have replaced human beings with robots, skilled employees are still required to ensure the smooth operations of advanced machinery. Schwab (2016) argued that the 4IR could affect the identity, privacy, ownership and consumption patterns of human beings.

Governments around the world should develop comprehensive responses to several challenges posed by the 4IR (Shava & Hofisi 2017:208). One of the most common challenges confronting governments in the digital era is the need to re-skill and up-skill public service employees in the face of digital challenges. Governments need to re-train their employees in order to improve their skills in line with the prevailing working environment (Stewart et al. 2015).

## Recommendations

The World Economic Forum (2016) suggests that in order to enjoy the benefits of the 4IR, several factors need to be considered and these include investment in human capital. Firstly, the digital environment requires the public service to fully embrace the digital transformation. The public service needs to first train its employees, so that they acquire the necessary skills and competencies required to effectively embrace the 4IR. If employees are not trained, it becomes difficult to align the skills with the machines, and as a result, it might lead to loss of jobs.

Closely related to knowledge on how to use modern machines is the issue of cyber security, associated dangers and the skills set, enabling the public service to deal with the challenge in its different forms, such as network security, application security, operational security and information security. Knowledge on electronic information security as well as cyber governance needs to be prioritised during training and development programmes for public service employees.

Furthermore, there is a need to create public awareness about the 4IR to influence a paradigm shift. The shift would entail massive human resource re-capacitation through the re-skilling and up-skilling of public officials. Secondly, training and development of human capital add value to organisations. Training programmes generally lacking in ICT competencies should be revised to incorporate new skills required for the digital era. Thirdly, promoting e-governance and managing this change must be prioritised. It is important that organisations have in their possession the most essential skills needed to match the latest technological developments (World Economic Forum 2016).

In addition, stakeholders in the education sector have a responsibility to incorporate the aspects of South Africa's 4IR

into the education system. Transformation of the curricula will prepare the country's future human resources to embrace technology, whilst enhance understanding and appreciation of the digital work environment. Although not all jobs can be replaced, a new set of skills should be developed to keep up with the new skill requirements. The public service needs to promote lifelong learning. Technical and vocational education can be expanded through online programmes tailor-made to enhance innovation and creativity amongst public officials. Equipped with the requisite skills, government employees can embrace the 4IR without any apprehension.

The need to protect workers from job losses remains a key issue to any progressive government, which can be achieved through the adoption of a policy framework that stipulates how the public service is expected to operate, whilst it ensures that employees are protected. A policy framework will clearly lay out how public institutions are expected to operate, thereby ensuring that employees are protected. There is a need for developing countries to invest in institutional structures to prepare future employees for the 4IR. It is recommended for South Africa to adopt the concept; however, more preparation in this regard is still required. Shava and Hofisi (2017:210) recommend that 'the 4IR needs to be strategically embraced, in order to promote the well-being and sustainability of communities'.

Key for South Africa to survive this new industrial revolution is strong leadership. This requires creating awareness of this change by government, and a massive investment by the government in developing and nurturing talent that can make most of this change happen with minimum impact on the workforce.

## Conclusion

Although it is still in its infancy, the 4IR is set to cause unpredictable and unimaginable changes. The study established that South Africa is one amongst the countries that have not yet fully embraced the digital transformation of the economy. The public service should utilise technology to help solve service delivery challenges. Employees need to possess relevant skills to enhance public-service delivery. Creativity and innovation should be encouraged through the adoption of science, technology and innovation policies relevant to the digital era.

Change drivers such as customers' taste and preferences need to be monitored. Skill development needs to be aligned with prevailing public demands. The government should consider investing in training and development programmes, with a view to capacitating the public officials to deal with the challenging aspects of the 4IR. The content and methods of teaching need thorough revision to reflect unique skills required in the digital age. Cyber security is one of the major concerns of governments; hence, public officials need to acquire the right skills set to improve cyber governance during the 4IR dispensation. If governments do not capacitate

public officials through further training, then the future of public administration and integrated service delivery is under threat.

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The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

### Authors' contributions

Although the authors worked together on the whole manuscript, N.T.N. was mainly responsible for the literature review, conceptualisation of the research and writing the draft version of the manuscript. A.M. worked on the research methodology and validation of information, whilst T.M. focused on the analysis, and reviewing and editing of the manuscript.

### Ethical considerations

This study followed all ethical standards for research without direct contact with human or animal subjects.

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### Data availability

The authors confirm that the data supporting the findings of this study are available within the article.

### Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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