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AN EVALUATION OF THE IMPACT OF ARTIFICIAL INTELLIGENCE ON TALENT MANAGEMENT: A CROSS-SECTIONAL STUDY APPROACH

A dissertation submitted to the School of Business Sciences at the University of the Witwatersrand, Johannesburg in fulfilment of the requirements for the award of the degree of Master of Commerce (Human Resources Management)

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DECLARATION

I, Tshegofatso Pearl Moagi, student number 0112909J declare that "An evaluation of the impact of artificial intelligence on talent management: A cross-sectional study approach" is my own work, and that all the sources that I have used or have quoted from have been indicated and acknowledged by means of complete references. I further declare that this work has not been submitted before for any degree of examination in any other academic institution.

_____ _____

Signature Date

ABSTRACT

The notion of the Fourth Industrial Revolution (4IR) is topical and has changed how organisations think about talent management and skills development for the contemporary workplace. Literature suggests that the 4IR will impact every industry and job type thus the need for organisations to prepare the workforce by equipping them with the requisite skills to function in this era (Cann, 2016; Schwab, 2016; Schreiber, 2017). However, the global challenge for academia, business, policymakers and other stakeholders is that the advent of the 4IR has led to some jobs being partially or fully automated thus exacerbating the skills shortage and leading to the hysteria of 'robots are taking our jobs'.

The main aim of this study was to determine the impact of the 4IR through artificial intelligence on talent management in selected organisations in Gauteng, South Africa. On this basis, three research questions were formulated for the study as follows: (i) How do organisations prepare the workforce for multiple job changes across occupational boundaries in the emerging 4th industrial revolution? (ii) What skills sets will the workforce require in order to function effectively in the 4th industrial revolution? (iii) What can government do to mitigate the perceived effect of the 4th industrial revolution on job losses? The research questions guided each phase of the research process for this empirical study using a qualitative research strategy. A non-probability sampling framework using purposive sampling techniques was used to collect data from eleven participants. Semi-structured interviews were conducted with organisational leaders from the core perspectives of human resources, the business partners to human resources and government. Nine themes and twenty-four sub-themes were identified using thematic analysis method. The themes of change management, training and development and talent management emerged as being pertinent to preparing the workforce for multiple job changes associated with the 4IR. The skill sets required to function effectively are technical competencies, methodological competencies, social competencies and personal competencies. Entrepreneurship and policy and legislation were the themes that emerged that government can use to mitigate the perceived effect on job losses.

The findings herein represent a meaningful and progressive contribution to existing literature on the 4IR by providing insights into the impact on talent management in the South African context. Moreover, this study provides practical implications that could assist organisational leaders and

policymakers in adopting strategies that equip the workforce with the requisite skills to deal with career changes across occupational boundaries in the advent of the 4IR. The limitations and recommendations of the study also provide a useful guide for future research consideration.

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DEDICATION

To my first teacher, my late dad, Peter Marlen Mosala Moagi. I have come a long way since you taught me “I” and “you”.

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CHAPTER 1

INTRODUCTION, PROBLEM STATEMENT AND OBJECTIVES OF THE STUDY

1.1 Introduction

This chapter introduces the concept of the 4IR and the anticipated impact on talent management. The chapter further provides the background to the study and formulates the research problem, research questions and the significance of the study. Based on the aforementioned, the research objectives are discussed. The preliminary literature overview will briefly outline the concept of the 4IR and the associated attributes and provide a theoretical framework for the study. The chapter is concluded with an outline of the chapters to this study and a summary.

1.2 Background to the study

The notion of "job for life" or the "possibility of rising up the career ladder after years of dedicated and loyal work" are outdated (Duarte, 2009, p. 259). The concept of 'employment' as recognised as per the industrial revolution has shifted to 'employability' in the postmodern era (Duarte, 2009). The focus of the modern workforce should be on 'employability' instead of job security, so that they can acquire the requisite skills that will develop and progress their careers (Patton & McMahon, 2014). The authors further emphasise that the knowledge and skills of an individual need to be securely created, not the job. Lasi, Fettke, Kemper, Feld and Hoffmann (2014) note that the current economy is challenged by the 4IR, which is triggered by economic, political, social and technological changes. Academia, government agencies, employers and business associations, CEOs from big firms and trade union leaders in many countries are convinced that the 4IR is underway and will reconstruct the universal production system and the community at large (Mahnkopf, 2019).

The 4IR, also called Industry 4.0, emerged in Germany in 2011 and is defined as "a trend related to automation and data exchanges based on the use of new technologies and their interconnectivity" (Fantoni, Chiarello, Fareri, Pira, & Guadagni, 2018, p. 76). The distinguishing factor of this new production paradigm to that of others is the exponential growth, worldwide scope and the assumed impact on economic, political and social structures (Last, 2016). Technologies

associated with the 4IR allow for direct communication between machines, devices and systems (Lasi et al., 2014). There are a few Industry 4.0 socio economic triggers that need to be considered, namely: lack of skilled labour force, an aging labour force, mass customisation, resource efficiency and clean urban production, shorter product life cycle, increasing product variability, dynamic value chain, cost reduction pressure and volatile markets (Shamim, Cang, Yu & Li, 2016). The primary aim of the 4IR is the reinforcement and expansion of the long-term competitive edge of the firm by increasing proficiency and flexibility of the production through intelligence, data and communication (Gabriel & Pessl, 2016). All these dynamics necessitates specialised management to mitigate the challenges associated with the 4IR (Shamim et al., 2016). Social innovation in the setting of the 4IR is key to addressing the growing concern of probable negative external influences on individuals and the community at large (Morrar, Arman & Mousa, 2017).

Global industrial systems are in evolution such that internet connected technologies are leveraged to create an added advantage for organisations and the community at large (Fantoni et al., 2018). Fantoni et al. (2018) suggest that entrepreneurs, researchers, policymakers and experts from various fields are embracing the topic, which requires companies to manage new technologies and relations thereof with an interdisciplinary approach.

Industry 4.0 requires an understanding of the consequences for the new world of work including emerging professional roles, as it will probably be harder to get to grips with due to the heterogeneity, complexities and static nature of systems governing job descriptions (Jiang, Li, Du & Wang, 2018).

Through the evaluation of 2000 work-related activities across 800 professions, a 2017 report by the McKinsey Global Institute indicated that almost 5 percent of professions can be fully automated through the use of popular technologies whilst 60 percent of professions have a minimum of 30 percent of automatable modules that can be achieved through the available technology. According to Cann (2016) the 4IR will result in a net loss of over five million jobs in fifteen developed economies and emerging markets. The growing likelihood of the exchange of the human role by novel technological innovations for instance artificial intelligence (AI), drones, internet of things (IOT) and robotics is significant (Morrar et al., 2017). Issues surrounding AI and

intelligent agents, robots and genetic algorithmic capabilities are influencing decision-making and prompting innovation for organisations already reeling with how to adjust their structure and strategy in a competitive global business environment (Pan, 2016; Müller & Bostrom, 2016). Specialists do however agree that people will still contribute significantly in the 4IR despite the higher degree of automation (Gabriel & Pessl, 2016). Employees must however obtain skills that are aligned to the socio-technological shifts in the workplace to retain their place (Kohlbacher, 2017). Jobs and skills displacement will impact all industries and geographical locations; hence most organisations believe that in the long-term investing in skills, is the better alternative to hiring more virtual or short-term workers, as it is crucial to the management of disruptions to the working population (Cann, 2016). There is an expectation of an evident shift across industries which is depicted by the advent of original business models, the disruption of incumbents and the restructuring of transportation, delivery systems, consumption and production (Christensen, Raynor & McDonald, 2015).

The 2016 Future of Jobs report by the World Economic Forum (WEF) is based on a survey of senior human resources professionals and strategy executives covering fifteen of the world's largest economies namely: Australia, Brazil, China, France, Germany, India, Italy, Japan, Mexico, South Africa, Turkey, the United Kingdom (UK), the United States of America (USA), plus the Association of Southeast Asian Nations (ASEAN) and Gulf Cooperation Council (GCC) groups. These economies combined account for 65 percent of the global labour force (Cann, 2016). The report further indicates that for the coming five-year period, approximately 7.1 million jobs could disappear due to digital innovation and transformation, two-thirds of which are administrative and office oriented (Cann, 2016). To illustrate the extent of disruption across professions, Schwab (2016) suggests that soon various work professions such as accountants, doctors, financial analysts, insurance underwriters, journalists, lawyers and librarians could be partially or entirely automated.

1.2.1 The Fourth Industrial Revolution

The 4IR is recognised as a movement from simple digitisation to innovation-based amalgamations of technologies which enable organisations to modernise their business models leading to job

creation, product innovation and social innovation (Lee et al., 2018). Furthermore, it is derived from innovative forms of decentralised and complex production processes which are entirely automated via the autonomous communication of devices and technology with each other along value chains (Karacay, 2018). Although presented as a new paradigm, the 4IR is rooted in existing technologies and frameworks (Fantoni et al., 2018). The concept can thus be interpreted as the recombination of current technologies applied with new ones in the manufacturing environment (Trappey et al., 2016).

The occurrence of the 4IR is fiercely debated, as some academics believe that it is merely a well-orchestrated marketing ploy by consulting firms (Lee et al., 2018). Furthermore, academics suggest that the term of the 4IR is not a universal phenomenon, but a solitary event reported in Korea (Lee et al., 2018). Several other studies have countered the criticism of the existence of the concept of the 4IR (Brynjolfsson & McAfee, 2014; Ford, 2015; Frey & Osborne, 2015; Shamim et al., 2016). Kim (2017) suggests that critics that question whether the 4IR can be termed the 'fourth' have underpinned their views on the Kondratieff wave theory. Kondratieff waves are long-term fluctuations of approximately 40-60 years which began with technological innovations thereafter sustained over prolonged periods of economic prosperity before an abrupt or prolonged slowdown (Kim, 2017). One of the frequently distributed market trend analyses postulates five such waves with the current technological and economic changes characterising the sixth wave (Naumer, Nacken & Scheurer, 2010). Further criticism of the 4IR is that the velocity, scope and systems aspect underpinning Schwab's 4IR are the hallmarks of the Third Industrial Revolution (Rifkin, 2011).

The relationship between business and technology is stronger than ever because 4IR technologies permit the formation of innovative business models and higher earnings through the provision of opportunity for the distribution of an extensive portfolio of goods and services (Geissbauer, Vedsø & Schrauf, 2016). Shamim et al. (2016) highlight that there are challenges presented by Industry 4.0 which involve prolific innovation and education, which is reliant on individuals and the proficiencies of organisations. Furthermore, predicting the type of jobs expected to emerge in the future workplace is problematic (Frey & Osborne, 2015). Arntz, Gregory and Zierahn (2016)

maintain that studies warning of technological unemployment due to the 4IR are methodologically flawed due to their focus on occupations rather than tasks. Schwab (2016) suggests:

> These are all fundamental changes affecting our economic, social and political systems which are difficult to undo, even if the process of globalization itself were to somehow be reversed. The question for all industries and companies, without exception, is no longer "Am I going to be disrupted?" but "When is disruption coming, what form will it take and how will it affect me and my organization?" (p. 17).

1.2.2 Industry 4.0 and the implications for talent management

Dries (2013) defines talent management as the expectation of the HR needs of an organisation, accompanied by a plan to address the identifed needs. Ulrich and Smallwood (2012) describe talent as "competence [knowledge, skills and values required for today's' and tomorrows' job; right skills, right place, right job, right time] commitment [willing to do the job] contribution [finding meaning and purpose in their job]" (p. 60).

Hungerland, Quitzau, Zuber, Ehrlich, Growitsch, Rische and Haß (2015) note the concerns around Industry 4.0 being the redundancy effect prevailing in the long run, leading to technological unemployment, however Roblek, Meško and Krapež (2016) are certain that job profiles will change at several workplaces. According to Weber (2015), the implications are that the chief reconstruction and revision occurrences will be amplified in the learning and employee development fields. Although predicting the anticipated skills needs to function in the 4IR is in its infancy, it is crucial to make inroads to identify the skills the workforce will need for the impending workplace (Fareri, Chiarello, Coli, Teloni, Dente & Fantoni, 2018). The interest is not solely on the capacity of new technologies to replace current jobs, but the creation of new job profiles that are emerging is equally important (Raine & Anderson, 2017). The question is, where do these emergent occupation profiles (also termed 4.0 Professional Archetypes), exist in the value chain? (Fareri et al., 2018).

Digital intelligence is changing the future work environment through humans and learning machines collaborating through neural networks which are continuously driven by a demand for

increased volumes cloud data, the usage of AI and big data to analyse and direct them (PwC, 2017). AI and robotics have created exciting opportunities for HR through intelligent analytical tools that can select candidates, determine the employees' career choices and provide assistance to managers to improve leadership skills (Jiang et al., 2018). However, many HR professionals remain hesitant to employ AI technology because they believe that algorithms cannot substitute human and intuition (PricewaterhouseCoopers, 2017). Lee et al. (2018) suggest that stipulation of jobs and professional expertise across several corporate models need to evolve through these technological developments as artificial intelligence offers a good digital infrastructure for HR planning (Jiang et al., 2018). Technological changes result in the development of new jobs which may be hard to spot due to the occupational classifications only being updated every ten years or so (Fantoni et al., 2018). The skills gap between the ideal abilities level and the current competences of the human resources function is diminished through talent management which addresses the gap through revealing the desired employee profile (Karatop, Kutab & Uygun, 2014).

1.2.3 The Chaos Theory of Careers

The contemporary career is viewed as 'chaotic' due to the intensive changes and its unpredictable nature (Pryor & Bright, 2011). Factors such as the constantly evolving external environment, global computerisation, significance of aspects of restructuration of networks and organisations are evidence of the dynamic, open and global postmodernist career (Raksnys, Valickas & Valickiene, 2015). The chaos theory of careers (CTC) (Bright & Pryor, 2005) and the happenstance learning theory (Krumboltz, 2009) from the area of vocational psychology aim to address the dynamic nature of careers. Although the CTC has theoretical prominence in career development discourse, it is thought to be unfamiliar to many vocational professionals as it has not been widely researched (Schlesinger & Daley, 2014). According to Cutright (1997) the origins of the chaos theory are from the nineteenth century when mathematician, Henri Poincare, revealed that the gravitational and orbital behaviour of bodies of the galaxy cannot be defined using simple, Newtonian, linear physics. Chaos theory thus adopts that a system forms its own direction and natural movement through the combination of conversions into its identity and thus ensures continuous expansion at an improved level of functioning (Bechtold, 1997).

1.2.4 The Fourth Industrial Revolution in the South African context

Roblek et al. (2016) view one positive aspect of the 4IR as being the effects of the value created from efficiency gains and new business models, however there may be a positive and negative impact associated with technological change. According to Kane, Palmer, Phillips and Kiron (2015) one of the challenges of the 4IR is that the restructuring of jobs may cause the disappearance of lower level occupations. Although the productivity gains that are evident from the use of smart technologies may support job security and bolster consumer demand through supplemental income (the compensation effect), likewise the utilisation of new productions technologies may decimate jobs (the redundancy effects) (Roblek et al., 2016). According to Rüßmann, Lorenz, Gerbert, Waldner, Justus, Engel and Harnisch (2015) countries and industries will nevertheless experience the 4IR in different ways and at different rates. The World Economic Forum (WEF) report identifies the main barriers for South Africa to adapt to the disruptions of the 4IR as follows: inadequate consideration of disruptive changes (68 percent), resource constraints (52 percent) and workforce strategy that is misaligned to innovation strategy (44 percent) (Hattingh, 2016). The aforementioned disruptions described raise 'flags' for changes that are required in the occupation-directed skills development system (Hattingh, 2016).

A key thought for the future in the digital economy is whether a culture of collectivism or individualism will be the prevailing cultural and societal trend for Industry 4.0 (PwC, 2017). Will societies work together to be collectively responsible or will there be a culture of 'me first'? (PwC, 2017). Whilst the advent of 4IR technologies and platforms aid inhabitants to engage with governments, the state is increasingly burdened to alter the systems of policymaking and civic engagement (Lee et al., 2018). Taking into consideration the macro-environmental factors of South Africa, what is the extent of the impact of Industry 4.0 and what solutions are suitable for the country?

Several studies indicate that career adaptability and hardiness are crucial constructs for people to develop the appropriate psychological strengths to deal with the career challenges given the rise in unemployment in South Africa (Tolentino, Garcia, Lu, Restubog, Bordia & Plewa, 2014; Zacher, 2014; Zhou, Guan, Xin, Mak & Deng, 2016). Bimrose and Hearne (2012) reiterate the viewpoint of Tolentino et al. (2014) that people want to advance their resilience and career

flexibility to survive the volatility of the existing labour markets. Galaske, Arndt, Friedrich, Bettenhausen and Anderl (2016) posit that non-skilled workers face a greater risk of being replaced by automated systems than experts. Gillwald (2019) suggests that South Africa has fallen for the 4IR hype that advances capitalism as 4IR is no different to previous revolutions. Furthermore, Gillwald (2019) suggests the following:

- The 4IR is not the panacea to redressing inequality and constructing an inclusive digital economy and society in South Africa.
- Government and international donors are redirecting public funding meant for poverty alleviation to research policies that support digital inclusion to AI, block chain, drones and machine learning.
- Technologies associated with the 4IR will not necessarily lead to empowering the marginalised, economic growth or job creation.

The CEO of IDEA Digital Education, Dr Corrin Varady, cautions that South Africa is out of its element to deal with the emerging 4IR (Smith, 2019). Reflecting on unemployment and the politicisation of education, Dr Varady suggests that a digital umbrella is not the solution to addressing the high unemployment rate and the appalling literacy and numeracy rates amongst learners, more so in a country with a huge digital divide (Smith, 2019). Moreover, Dr Varady advocates for a long-term view of education to strengthening the structural pillars instead of a quick fix. Likewise, co-founder and executive director of the Apolitical Academy, Lindiwe Mazibuko, was also concerned about the undereducated workforce and youth unemployment in the wake of the 4IR. Based on their research on the structural transformation of South Africa, Bell, Goga, Mandliwa and Roberts (2018) believe that the nation is not adequately equipped for the 4IR because its market concentration is blocking liberalisation. The authors forewarn that the economic divide may worsen as a result of the technological divide. Levin (2018) suggests that, “In theory, new technological paradigms should allow countries like South Africa to leapfrog some of the older established economies: in practice, it would take an immense effort of public sector coordination, education and private sector mobilisation to get the enabling factors in place” (p. 28).

1.3 Statement of the research problem

The human resources profession is facing numerous pressures for transformation due to shifts in domestic diversity, the economy, technology and globalisation creating new demands for organisations, which is propelling the career into new territories (Stone & Deadrick, 2015). The reality of the disruption and predictability of the effect of the 4IR, means that organisations have the responsibility to determine policies and to endorse the changes that should provide an opportunity for all (Schwab, 2016). Holistic, adaptive and agile talent capabilities and abilities are essential in this era of disruption due to the arrival of the 4IR (Johnson, Teo & Sim-Lim, 2018).

Over the next few years, intelligent machines will infiltrate businesses leading to an unprecedented opportunity for organisations to reveal their true potential and true value of their workforce in the era of Industry 4.0 (Shanks, Sinha & Thomas, 2016). Artificial intelligence leads managers to faster, more thoughtful and collaborative decisions because it takes on routine tasks like, planning, scheduling and optimisation, which allows managers to focus on strategic and more creative functions through skills that machines do not possess such as intuition, ethical reasoning and making judgement calls (Shanks et al., 2016). The authors note that managers are not ready to make that transition and the problem lies therein.

At a 2017 Conference hosted by the Council for Scientific and Industrial Research in South Africa, Mark Saunders reported that South Africa is underprepared for the 4IR (Campbell, 2017). Technological evolution requires a workforce that can keep abreast with these developments (Kohlbacher, 2017). Saunders reiterated that human capital is important as a country will not be able to harness the new production technologies with an inadequately prepared workforce (Campbell, 2017). A key concern prompting HR developments is the shift from a manufacturing economy to one that is predominantly service or knowledge-based (Stone & Deadrick, 2015). If the manufacturing sector in South Africa is unprepared for the disruption associated with Industry 4.0, it could result in more job losses, due to markets lost to international competitors using innovative technologies (Campbell, 2017). Industry 4.0 is predicted to disrupt all industries; restructure how we communicate, relate, learn and work; and reimagine how institutes from schooling to transportation operate (Schreiber, 2017). Redefining disruption has led organisations to re-evaluate the tools required to succeed and HR holds a significant role in enabling this (Hewitt,

2014). One critical fear emerging from Industry 4.0 is that automation and robots will steadily take control of a considerable number of tasks currently performed by humans (Ford, 2015). The result may be that certain jobs may become obsolete or redundant due to automation and the digitisation of manufacturing processes, the qualification criteria of emerging occupations will be extra stringent with fresh knowledge and skills being vital (Morrar et al., 2017). Although smart machines and systems are automating routine tasks and decision-making, the need remains for employees that can provide expert analysis (Gilchrist, 2016). Nowadays, the essential tool for business intelligence is predictive analysis, which uses big data for vast amounts of intellect to gain business insight (Gilchrist, 2016).

Organisations that do not have the systems and culture established to identify, attract and nurture the right talent to drive disruption and innovation from within, could find themselves unable to compete and possibly out of business in the future (Hewitt, 2014). Industry 4.0 is primarily knowledge-based and requires new competencies, thus one of the core policy issues is to recognise how the demand impacts the occupational structure of the labour marketplace and skill sets needed (Lee et al., 2018). The future workforce entails multi-disciplined generalists in possession of computer, mechanical and process engineering skills (Gilchrist, 2016). Soft skills will also be a requirement with management, self-organisation, teamwork or communication skills gaining prominence in the emerging labour market (Kergroach, 2017). A study by the WEF, titled 'Future of Jobs' revealed that less than fifty percent of senior human resources professionals are at least rationally assured that their organisation's workforce strategy can deal with these changes. Saunders and Baeck (2015) view the primary barriers to a more decisive technique being inadequate or misalignment between the workforce strategies and the firms' innovation strategies, organisations' absence of consideration of the form of disruptive shifts, resource constraints and interim pressures in profitability, amongst others.

1.4 Research questions

Deriving from the research problem articulated in this study, the resulting research questions are thus stated:

1. How do organisations in South Africa prepare the workforce for multiple job changes across occupational boundaries in the emerging 4th industrial revolution?

2. What skills sets will the workforce require in order to function effectively in the 4th industrial revolution?

3. What can government do to mitigate the perceived effect of the 4th industrial revolution on job losses?

1.5 Objectives of the study

The broad purpose of the present study was to determine the effect of the emergence of artificial intelligence within the context of the 4IR on talent management in elected organisations in Gauteng, South Africa. Specific objectives arising from the research questions are:

1. To evaluate how organisations are preparing their workforce for multiple job changes across occupational boundaries in the emerging 4IR.
2. To identify the skill sets that would be required by employees in order to function effectively in the 4IR.
3. To identify the role of government in mitigating the perceived effect of the 4IR on job losses.

1.6. Justification for the study

South African organisations generally lack the skills to discover insights through analysis of multiple data sources, thus failing to propose and produce programmes that are based on the insights generated (Mbonyane & Ladzani, 2011; Iyamu, 2018). Moreover, there is limited knowledge of what data mining and Industry 4.0 entails (Rygielski, Wang & Yen, 2002; Malapane, 2019). “The readiness of countries, including South Africa (SA), and whether and how they have prepared, planned and organised for this revolution, offers little empirical research” (Lekhanya, 2019, p.1). To date, there is no clarity regarding social re-skilling, human resources readiness, infrastructural adjustments, technology up scaling, and economic re-capitalisation (Lekhanya, 2019).

According to Hirschi (2017) the accelerating, digitisation and automation of work resulting from the 4IR, will have a huge bearing on individuals' career experiences. Job losses are identified as one of the social challenges of the 4IR due to the mechanisation of vast sectors of operations in various industries (Morrar et al., 2017). The expectations of Bryjolfsson and McAfee (2014) are that new industries, new occupations and habits of operating at work will appear. Digitisation and automation could be amongst the most critical topics to direct the prospect of career counselling, career choices and career development (Hirschi, 2017). The aim of the higher education sector is to train students for the contemporary workplace across industries by equipping them with knowledge about the processes in various industries (Eberhard et al., 2017). It is therefore surprising that academic literature in career counselling, career studies and vocational psychology has been mum on this major development, similarly in the fields of organisation and management studies (Barley, Bechky & Milliken, 2017).

According to Oosthuizen (2017), the dramatic rise in the advancement of technology and its influence on leadership training in the workplace cannot be negated. Moreover, the construction of knowledge in relation thereto lacks scientific rigour and subsequent leadership practice implications. The justification for this study was thus motivated by its contribution to theory in the disciplines of organisation and management studies. Furthermore, there is a paucity of enquiry about how the 4IR would impact talent management in South African firms. The exploratory approach to the study was therefore key to theory building and expanding our limited knowledge of the concept of the 4IR and provide additional academic literature on the subject. This will enable organisational leaders, academia, government and other stakeholders to identify the relevant skills for this era and implement effective human resources practices and policies to prepare the workforce for the 4IR workplace.

1.7 Delineation of the study

The study is restricted to researching the extent and nature of the effect of artificial intelligence within the context of the 4IR on talent management in select private and public sector organisations based in the Gauteng province, South Africa. The organisational leaders selected to participate in the study were subject matter experts from within HR, business partners to HR and leaders within government at the strategic level, thus providing a multidisciplinary view of the research topic. The findings herein are representative of the experiences and perceptions of some organisational

leaders and thus excludes the experiences and perceptions of organisational leaders whose functions who do not interact with HR in their job functions. The findings may thus differ in other industries.

1.8 Outline of the study

This study is structured as a dissertation comprising five chapters as follows:

Chapter 1: Introduces the study through provision of a background to the study, statement of the research problem, research questions, description of the objectives of the study, significance of the study and a brief literature review.

Chapter 2: Provides a detailed review of the literature of the 4IR as it pertains to talent management and the theoretical framework for the study.

Chapter 3: Presents a comprehensive discussion of the research methodology and the research design of the study.

Chapter 4: Presents the findings of the study, including an analysis of the results.

Chapter 5: Provides a summary and conclusion grounded on the findings of the study on the impact of artificial intelligence within the context of the 4IR on talent management in Gauteng organisations.

1.9 Summary of chapter

This chapter provided an introduction and a brief background to the phenomenon under investigation. The chapter articulated the statement of the problem, the study objectives and research questions. The scope of the study was discussed and finally this chapter provides an outline of each of the chapters presented.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The preceding chapter introduced the study and provided a summary of the upcoming chapters. This chapter delivers a critical literature review on the topic under study. Moreover, the chapter discusses the concept and drivers of the 4IR, the role of artificial intelligence and the associated benefits and risks. The chapter also examines the effect of the 4IR on human resource management. Similarly, the concept of talent management, role of government in Industry 4.0 and skills development were also discussed. The theoretical framework for this study is discussed with focus on disruption theory and the career development theory of chaos. The protean and boundaryless career models concludes the chapter.

2.2 Conceptualising the Fourth Industrial Revolution

The Industry 4.0 concept was formally introduced at a technology fair in Hannover, Germany in October 2011 (Kagermann, Lukas & Wahlster, 2011). The theory is primarily characterised by greater flexibility and a higher cross-linking degree of available information through real-time communication facilitated by the internet and smart technology (Picot & Neuburger, 2013; Binner, 2014). In accordance to Bauer, Schlund, Marrrenbach and Ganschar (2014) the industrial internet of things (IIoT) is created by information and communication technology (ICT) systems to manage intricate systems and the instantaneous capable, intellectual, horizontal and vertical connection of people, machines and objects. Fundamentally, a rise in the application of software technologies and AI into a company's physical process of the value chain – irrespective of whether it relates to essential management or support processes – is central to the 4IR (Lee, Kao & Yang, 2014). The aim of the 4IR is thus to connect information that has been treated separately, since the accessibility to continuous and consistent data within a company is one of the most significant basic requirements to effectively design optimisation models in today's business environment (Binner, 2014). The 4IR is described as the subsequent point in the digitisation of the manufacturing industry which is determined by four disruptions: (1) the astounding increase in data volumes, computational power and connectivity, particularly low-power wide-area networks; (2) the advent

of analytics and business-intelligence competences; (3) new systems of human-machine interfacing for example augmented reality (AR) systems and touch interfaces; and (4) developments in the transference of digital commands to the physical world, for example 3D printing and advanced robotics (Baur & Wee, 2014).

Table 2.1: Summary of definitions of industry 4.0

Definition	Author (s)
Industry 4.0 is the modification and re-organisation of value chains to a networked coordination in the age of the 4IR. Moreover, the 4IR uses the distinct requests of customers in real-time and environment balances (known as big data) from all applicant foundations of the value chain to integrate the production process.	Platform I4.0 (2015)
Industry 4.0 is the combination of numerous technological expansions that encompasses processes and products relating to the so-called cyber-physical systems (CPS) that defines the fusion of digital and physical workflow.	Schmidt et al. (2015)
Industry 4.0 connects products and services to one another through their corresponding environment via internet and additional network services that allow the development of new service products so that several functions of products work independent of human involvement.	Sendler (2013)
Industry 4.0 realises an optimised collaborative value (smarter services and processes) by a smart collaboration of original and improved proficiencies in a supply system based on new technologies, particularly ICT.	Felser (2015)
Industry 4.0 involves smart products being embedded into digital and physical processes through interaction with each other and across geographical and organisational borders.	Schmidt et al. (2015)
Industry 4.0 is a collection of the following concepts: adaptation to human needs, CPS, corporate social responsibility, new systems in the advance of products and services, new systems in distribution and procurement, self-organisation and smart factories.	Kagermann, Wahlster & Helbig (2013)
Industry 4.0 is growth driven by innovation within a range of manufacturing firms.	Binner, 2014

Shamim et al. (2016) detail the characteristics of the 4IR to include smart manufacturing, applying CPS for production, namely, connecting machineries to the value stream, embedded actuators and sensors and networks of microcomputers. Furthermore, it encompasses the digital development and re-engineering of products and is characterised by vastly differentiated products that are customised, a blend of value-added products and services, value-added and an effectual supply chain (Shamim et al., 2016). The organisational and technical changes indicate frequently modernised and dynamic skills profiles, necessitating reassessment of qualifications through innovative learning platforms in the workplace (Kravčík, Ullrich & Igel, 2017). The approaches adopted by management can perform a crucial part in the progression of dynamic proficiencies and the development of active learning and creating an innovation culture (Kravčík et al., 2017). Shamim et al. (2016) assert:

> Since the evolution of industrialization, industry experienced the paradigm shifts due to technological changes and innovations. These paradigm shifts are known as "industrial revolutions", for example, mechanisation (1st industrial revolution), high use of electrical energy (2nd industrial revolution), electronics and automation (3rd industrial revolution) (p.5309).

Over the last couple of years, a majority of the most advanced economies and one of the fastest growing economies globally, China, have witnessed a major drop in their labour share calculated as a proportion of the gross domestic product (GDP) (Schwab, 2016). Fifty percent of this decline is attributed to a decline in the comparative price of investment goods, which is influenced by the growth in innovation, compelling organisations to replace labour for capital (Frey & Osborne, 2015). Customisation and cost reduction are not designed to work concurrently, as customisation leads to additional cost and the product life cycle is reduced due to trends shifting, thus firms focussing on short term innovation (Li et al., 2016). Big world economies like China are faced with the trial of maintaining spotless urban production resulting from high levels of pollution and as with Japan, the problem of an aging workforce (Li et al., 2016). The digital age is predicted to cause greater chaos than prior technological revolutions as it is at a fast pace and is essentially changing how we live and work (Frey & Osborne, 2015).

Organisations need to find solutions to balance the risks and benefits of digital and industry platforms to avert the wield of power and value by a minority (Schwab, 2016). The consequences are that those who will benefit immensely from the 4IR are those with the academic or physical capital (investors, visionaries and shareholders), which illustrates the mounting gap in affluence between those who own capital and those who depend on their labour (Schwab, 2016). This solution, Schwab (2016) suggests, can be achieved by ensuring opportunities and openness for collaboration in modernisation and innovation. The author further suggests that these vital changes impacting our economic, the social and the political structures are hard to reverse, even if globalisation were by some means undone because industries and organisations will inevitably be disrupted. Industries and organisations therefore need to enquire when disruption will happen, its form and how it will impact them and their organisation (Schwab, 2016).

2.2.1 Drivers and constraints of the Fourth Industrial Revolution

The two main drivers of the 4IR are the growth of trades from the epoch of pre to post Fordism, and contrarily, the advancement of the internet or the 'digital world' associated with the web (Lee et al., 2018). The indicators of this combination mark the technological facet of Industry 4.0, including the key dimensions of: 3D printing, AI, augmented reality, automisation, big data, blockchains, connectivity, intelligent agents, machine learning, robotics, sensors and virtuality (Lee et al., 2018). The new strain of robots is expected to produce a growing accent on human-machine collaboration. Technological change is central to creative destruction and is described by Schumpeter (1942) as:

> The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets… [This process] incessantly revolutionises the economic structure from within, incessantly destroying the old one, incessantly creating a new one. This process of creative destruction is the essential fact about capitalism (p. 83).

Although the scientific interest in the technological features of the 4IR is gaining momentum, an understanding of the consequences for the workplace and future professional roles that are likely

to arise prove to be harder to grapple with due to the complexity, heterogeneity and static nature of job descriptions (Fantoni et al., 2018). Although jobs and industries that exist today, including tourism, nanotechnology and engineering, could not have been predicted by anyone in the early twentieth century, we have an inkling of the nature of jobs that are evolving (Frey & Osborne, 2015). Examples of occupations resulting from new technologies that hardly existed on the professional platform LinkedIn five years ago are cloud services specialists, big data specialists, iOS developers, digital marketers and data scientists (Frey, 2014). Furthermore, the author lists bioinformatics scientists, biomass plant technicians, informatics nurse specialists, solar energy systems engineers and wind energy engineers as other examples of new and emerging occupational titles. Frey and Osborne (2015) suggest that public spending in these promising technologies could facilitate new job creation. Although the jobs are very different, the common characteristic is that they require greater skills than those from yesteryear (Frey & Osborne, 2015).

Although education remains a key factor to addressing the skills requirements for this era, it is unlikely to resolve the problem of increasing inequality (Frey & Osborne, 2015). Scarcity of skilled workers as opposed to the abundance of capital, is predicted to most likely be the crippling constraint to competitiveness, growth and innovation (Schwab, 2016), resulting in increasingly segregated labour markets of low skill/ low-pay and also high skill/ high pay sectors. (Ford, 2015). A further prediction by Silicon Valley entrepreneur and author, Martin Ford, is that the whole base of the job skills pyramid will be hollowed out, leading to greater inequality and increased social tensions unless we act to adequately prepare for these changes (Ford, 2015). According to Frey and Osborne (2015) there is concern that the adoption of labour-saving interventions could possibly be due to cheap labour which is a regulatory concern influencing political activism thus impeding technological adoption. An example is that of resistance to the app-based company Uber, from traditional meter taxi organisations, whereby cease-and-desist orders are prevalent in Brisbane, Frankfurt and Taiwan, and led to the closing down of its Spanish operations entirely (Frey & Osborne, 2015). Likewise, in South Africa, eight regional taxi organisations and members of the South African Meter Taxi Association have complained to the Competition Commission alleging that the ride-hailing organisation has engaged in predatory pricing and other anti-competitive behaviour (Maseko & Davids, 2016).

Software patent "trolls" have taken advantage of poorly crafted patents with claims directly costing companies approximately $29 billion in 2011, thus impeding technological deployment (Bessen & Meurer, 2014). Organisations face difficulties related to forecasting technological progress due to the influence of emergent technologies (Armstrong, Sotala & Ó hÉigeartaigh, 2014). The challenges listed are insightful in staking on the expansion of machine intelligence viable with human labour as the field of AI is dismal in predicting when human-level intelligence may be algorithmically possible (Frey & Osborne, 2015). Organisations have a duty to establish shared values that determine policy choices and endorse changes that create an opportunity for all, so that the gap between the degree of the imminent changes and the relatively marginal action companies take in addressing these challenges is minimal (Schwab, 2016). Organisations are thus compelled to adopt a renewed outlook to address their own talent needs to alleviate undesirable social outcomes (Schwab, 2016).

2.2.2 Opportunities and risks associated with Industry 4.0

According to industry-wide consultations, the implementation of the 4IR in practice have brought the following snags to the fore: there is little strategic direction, the problem of perception about the complexity of the concept of Industry 4.0, uncertainty about the outcomes of benefits and costs associated with the 4IR, and failure of assessing capability of enterprise thereof (Salkin, Ustundag & Cevikcan, 2018). Moreover, Sarvari, Ustundag & Cevikcan (2018) identified the challenges for Industry 4.0 transformation as follows:

- Lack of knowledge about the technologies available and the opportunities created.
- Uncertainty about the benefits provided by technology investments on products and processes.
- Lack of knowledge about customers' requirements regarding new products and business models under the Industry 4.0 vision.
- Limited financial and human resources.
- Difficulties in spotting the starting point and milestones in the planning horizon.

- The need for efficient portfolio management for technology investments.
- Requirements for prioritisation and scheduling of new product and process projects.
- Allocation of limited resources to the projects and collaboration with reliable partners.
- Limited communication about the benefits of the Industry 4.0 transformation projects via the enterprise.

An advantage of the 4IR is that there is an opportunity to improve the value of our lives, enabling employees to work smarter through needs and wants as is evident by greater efficiency and productive digital and production systems (Lee et al., 2018). Interaction and connectivity between machines, parts and humans will speed up the production system by 30 percent and increase efficiency by 25 percent and strengthen customisation at peak levels (Ganzarain & Errasti, 2016). All tasks that could potentially be automated and digitised will be fixed into intelligent machines and those jobs that are created on codifiable data will be done by robots (Lee et al., 2018). Routine-based roles will decline and the tasks of employees within organisations will be gradually linked to auditing tasks, innovative and critical thinking (Lee et al., 2018). The 4IR will also alter the manufacture, design, operation and service of products and associated systems (Lee et al., 2018). Another feature of the 4IR firm is the ability to anticipate future products and to adequately meet intensity in variability and complication with low cost and low environmental impact (Hermann, Schmidt, Kurle & Thiede, 2014). It will thus have a major advantage, employability and manufacturing investments effect (Ganzarain & Errasti, 2016).

Table 2.2: Opportunities and risks of the 4IR

Opportunities	Risks
Creation of new knowledge, jobs, products and services.	Jobless growth with significant levels of job destruction.
Productivity gains and increasingly bespoke products and responsive services.	Emergence of dominant oligopolies and increased concentrations of wealth.
Improved ergonomics and augmented labour.	Precarious and polarised labour markets.
Abolition of dangerous, repetitive and routine tasks.	Acute skills shortages in areas of growth and a mismatch between the demand for skills and the supply of education and training.
A connected world, open systems, and increased transparency and accountability.	The extension and intensification of monitoring, surveillance and the erosion of privacy.
New collaborative and cooperative organisational forms, relations and practices.	Increased opportunities for cybercrime and disruptive political and economic agents.
Possibilities of social emancipation and reductions in social, political and economic inequalities.	Digital Taylorism and an 'algorithmic' management of behaviour.
	Policy and regulatory lag, including the weakening of collective action and social protection systems.

Source: Connor (2018, p. 5)

An effort to gauge the maturity level in every section of the 4IR can help organisations understand the strengths they can build on and which processes/ systems are required for future solutions (Sarvari et al., 2018). Organisations need to start implementing data collection and conducting complete data analyses on existing and forthcoming work designs, to have greater knowledge of the roles which are likely to be digitised in their industry and which other functions will be required in line with constant automations to develop talent development processes for the current digital revolution (Karacay, 2018). Some call it the 'Analytics Revolution' which can convert organisations and societies; however, research on analytics is still emerging with numerous organisations finding it tough to comprehend how, when and where to use analytics to their benefit (Kiron, Ferguson & Prentice, 2013). According to Rasmussen and Ulrich (2015), the goal of data analytics is to convert huge complex masses of data into knowledge and aid the managerial process of human resource management (HRM) through making more precise and data driven decisions and forecasting the future, not just describing the past.

2.2.3 Data analytics

Data analytics involves the denotation of raw data by means of specialised computer systems (Onar, Ustundag, Kadaifci & Oztaysi, 2018). The foundations of data analytics are: descriptive analytics which deals with processing data for sustaining a review of historical statistics to generate valuable data; predictive analytics which focuses on detecting the probability of future consequences of probable activities using algorithms and historical data; prescriptive analytics which attempts to identify the best trajectory based on the aims and constrictions of an issue (Onar et al., 2018). Analysis and interpretation of big data within academia can assist our understanding of learning processes, also effectiveness, proficiency and appeal of learning and training in the workplace, making them more authentic and therefore more motivating, which is vital (Kravčík et al., 2017). Digital intelligence is changing the workplace through humans and learning technologies collaborating within neural networks, powered by a continuously growing volume of data in the cloud and the use of big data and AI to analyse and direct them (PricewaterhouseCoopers, 2017).

2.3 Capabilities of artificial intelligence

AI, namely the facility of systems and machines to garner knowledge through performance of cognitive tasks and intelligent behaviours, allows for modern robots and software to study and function autonomously from human choice by becoming self-directed agents (Kergroach, 2017). Moreover, robots enabled through AI technology will progressively be fundamental to the logistics and industrial functions as they could ensure precision, productivity, safety and speed (Kergroach, 2017). Accordingly,

> the artificial intelligence (AI) application of machine learning, with a focus on how supervised computers can access data and learn from it, and deep learning, a subset of machine learning that uses networks and learn unsupervised, may still be seen by many as science fiction concepts or just in the infancy of their applications, but evidence shows this type of technology is growing at a rapid pace (Johnston, 2018, p. 28).

The convergence of AI and technology, big data and analytics, and disparate functions such as assimilation software and additive manufacturing functioning together has meant an increasing awareness in the extent these technologies will impact business (Brynjolfsson & McAfee, 2014). "Nowadays, manufacturing companies have been working based on people-oriented approach. Customer satisfaction is currently not only for external customers but also required for internal customers" (Karatop et al., 2014, p. 127). HR is thus one of the most vital resources for manufacturing firms to manage in terms of customer relations, personnel and managers (Karatop et al, 2014). HR is often a step behind in digital transformation, but AI now offers the opportunity to catch up (PricewaterhouseCoopers, 2017). Over three decades ago, AI disrupted the domain in the arrangement of expert systems (also known as knowledge-based systems and reasoning systems) with the aim to advance the efficiency and usefulness of support to policymakers (Siau, Lacity & Sauter, 2018).

There are difficulties associated with forecasting technological progress in pre-empting the effect of emergent technologies (Armstrong et al., 2014). In 1970 Artificial Intelligence pioneer Marvin Minsky claimed that in approximately three to eight years a tool with the general intelligence of the average human will exist (Frey & Osborne, 2015). However, the realisation date of human-

level AI features many difficulties that are problematic to predict (Armstrong et al., 2014). Feedback on the accuracy of the predictions are mainly unavailable as the problem is challenging to dissect and growth in AI is, to a degree, reliant on startling perceptions (Frey & Osborne, 2015). Notwithstanding these challenges, we can rationally assume that human-level AI is not too far off (Frey & Osborne, 2015). A recent survey of AI experts conclude that we are likely to achieve (with over 50 percent probability) overall human capacity in machine intelligence by 2040-2050, and highly likely (with 90 percent probability) by 2075 (Müller & Bostrom, 2016). Nevertheless, one need not wait for these calculations to be verified to witness the employment effect resulting from these intelligent machines (Frey & Osborne, 2015). Frey and Osborne (2015) state:

> At all stages en-route to true human-level AI, we expect to see technologies that will radically alter the nature of work. For governments to adequately respond to these trends, a shift in mind-set, investment and policies is needed. As around 47 percent of jobs are at risk of displacement by technologies that are largely already available that shift needs to happen sooner rather than later (p. 84).

A report by McKinsey (2016) indicated that current established technologies could automate 45 percent of the tasks for which employees are compensated and of approximately 60 percent of entire occupations, 30 percent or more fundamental activities might be automated using available technologies. Furthermore, AI will struggle to replace application of expertise, management, stakeholder interaction and unpredictable work (McKinsey, 2016). A 2014 global study conducted by Hanover Research revealed that whilst talent mapping and succession planning were said to be based on current performance and future potential, analysis of future potential was seldom conducted leaving many talented employees without a progressive path (Newhall, 2015). “Within the next twenty years, however, rapid developments in AI are expected to result in breakthroughs based on deep learning that reflects the way children learn. Creativity might therefore not ultimately be the exclusive domain of humankind” (Callaghan, 2018 p. 112). Tarry (2018) suggests that the increasing influence of AI requires contemplation from three fundamental standpoints:

- The use of AI within HR.

- The use of AI in the business HR serves.

- The use of AI in wider society and the global context.

Research indicates that around 40 percent of the HR roles of global organisations are presently utilising AI applications, most of which are based in the US, with European and Asian companies lagging (PricewaterhouseCoopers, 2017). The outcome of the 20th CEO Survey (2017) conducted by PricewaterhouseCoopers indicates that a growing number of global leaders now realise the worth of AI supporting the management of their labour force as follows: 50 percent will invest in data analytics and develop talents; 39 percent are seeing the impact on future skills needs and 63 percent are re-evaluating the evolving duties of the HR department. The rapid advancement of automation, robotics and AI has changed the job types and the accessible numbers and techniques to establish work relations (PricewaterhouseCoopers, 2017). Employees performing tasks which automation cannot yet crack, with skills such as creativity, design, imagination and innovation will be prioritised by employers (PricewaterhouseCoopers, 2017). The business leaders interviewed for the 20th CEO survey claim that having consistent, diverse and multi-disciplinary talent is the success factor of digital transformation as hiring the wrong people lacking the requisite skills will slow down transformation, leading to the company gradually losing its license to operate (PricewaterhouseCoopers, 2017). A recent survey indicated that only 13 percent of employees in the Organisation for Economic Co-operation and Development (OECD) countries and markets use crucial data-processing skills daily, namely: literacy, numeracy and problem-solving skills with higher proficiency than computers (Elliott, 2017).

2.4 Human resources management and Industry 4.0

According to Jones, Firth, Hannibal and Ogunseyin (2019), the issue of change occupies the minds of most managers, hence management development and change management strategies currently being the topmost priorities for several HR development specialists. Leifer (1989) views transformation as a standard reaction to uncertain, variable, internal and/ or external situations. Although change subsists in all people, all organisations and in all sectors (Todnem By, 2005), we live and work in a volatile, uncertain, complex and ambiguous (VUCA) world (Rodriguez & Rodriguez, 2015) where change is deemed to be complex, constant, ubiquitous, increasing in pace,

fluid and comes in many forms (Jones et al., 2019). The change management process thus needs to be structured such that people, processes and technology are managed to respond to the changing corporate strategies to remain relevant and competitive (Anyieni, 2016). Although the oversight role of HRM includes the recruitment cycle and managing employees through performance management, HR is often excluded from the change process in an organisation (Hee & Shanmugam, 2019). The challenge posed by the current generation for organisational heads and particularly for human resources managers is the question of how to manage talent efficiently as they possess inimitable proficiencies and knowledge (Bui & Tian Van Zyl, 2016).

The last century has seen development in technology, industrial revolutions and a general change in demographic which has significantly impacted how organisations manage employees and thus led to critical conversion in the context of HRM (Datta, Guthrie & Wright, 2005; Eckhardt, Laumer, Maier & Weitzel, 2014). A shift in the processing of HRM is driven by technological trends such as movements in the scope of IT and changes in the development of machinery and industry (Datta et al., 2005). Moreover, human resource strategies also deal with the development of constant improvement and customer relations strategies (Datta et al., 2005). The HRM strategy needs to include a distinct goal and a set of unified standards (Purcell, Kinnie, Hutchinson, Rayton & Swart, 2003). Human resources is a creation of the human relations movement from the early twentieth century, when the research fraternity developed an interest in recording methods of producing commercial value through the strategic management of employees (Murthy, Heeramani & Nagaraj, 2017). Ulrich and Dulebohn (2015) suggest that human resource management can be divided into four categories namely: information, people, performance and work, whereby:

- Information refers to how information is distributed within an organisation.
- People refers to the human aspect such as workforce management in organisations which in turn refers HR practices like staffing and development and workforce planning.
- Performance looks at the realisation of work by employees through development and measurement in practice.
- Work discusses methods by which work is completed within organisations.

The purpose of HRM within organisations is to maximise employee performance in alignment with the strategic objectives of an employer (Murthy et al., 2017). The birth of strategic human resource management (SHRM) is strongly associated with the wider concept of strategic management (Jackson, Schuler & Jiang, 2014). A strategy is classified as a time-based proposal which depicts where an industry or firm is, where it is required to go and the direction taken to reach that destination (Sarvari, Ustundag, Cevikcan, Kaya & Cebi, 2018). SHRM is a long-term outlook which involves topics such as corporate culture and personal career development and the availability of people with the requisite skills (Price, 2007). Moreover, it comprises redundancy and recruitment planning and is gradually focussed on decisions about sustaining the internal competence of an organisation's labour force to achieve specific roles or to outsource a function to an external service provider (Price, 2007). Revision of the constantly revised knowledge domain and the notion of human resource management indicates that it was only during the 1980s to 2000, HRM regarded personnel as 'human resources' who are vital organisational 'assets' (Barman & Das, 2018). Complementary and integrated management strategies are required for HR to assure their individual and collective contributions to achieving organisational goals (Rotich, 2015).

HRM will remain the basis of competitive advantage for local and international firms alike and established and emerging markets in the universal economy of the this century which encompasses knowledge, globalisation, innovation, services and technology (Thite, 2015). HRM has evolved to the next level, where other considerations are made than in the traditional field of human resources' purview (Datta et al., 2005). Farndale, Scullion and Sparrow (2010) assert that technological changes and the strides in globalisation have underscored the imperativeness of a greater strategic position in HRM, mainly in talent management. HRM practices and policies are systematically used to attract, develop and retain talented workers with scarce skills required to achieve strategic goals and maintain competetive advantage (Tarique & Schuler, 2010). According to Stone and Dulebohn (2013) the growth associated with the knowledge economy has pressured organisations to review HR practices and organisational goals. The HR function therefore needs to move beyond efficiency to HR effectiveness and impact (Stone & Dulebohn, 2013).

The world has entered an unprecedented period of HR technology solutions that has propelled HRM to a level whereby immense improvisation and modern workforce solutions are supported

to attain a superior employee experience and enhanced sustainable performance (Barman & Das, 2018). Changes in the HR field is attributed to increased generational diversity, a rise in globalisation and attention to modernisation and sustainability (Ulrich, 2013; Boudreau, Gibson & Ziskin, 2014). Several traditional HR processes eminate from a bygone era, and were largely concerned with manufacturing organisations that converted raw materials, parts and components into finished products to meet customers' expectations (Stone & Deadrick, 2015). The current economy is marked by a decline in growth and manufacturing in service or knowledge as the basis of the economic hub (Stone & Deadrick, 2015). The second stage of HRM – commonly known as HR '2.0' is strongly characterised by the integration of social media networks and software applictions into daily HR practices (Doherty, 2010; Eckhardt et al., 2014), but also an overall shift from an operational and administrative tasks focus towards a more strategic focus to HRM (Datta et al., 2005). Additionally, other sources state that Industry 4.0 represents more or less the same as HR 2.0. The 4IR is thus what has determined the evolvement of HR 2.0, which suggests that these two terms are actually interdependent (Picot & Neuburger, 2013). The current age of the thinking machine which is applied through the HR intelligence quotient (IQ) system advanced by the IQ dynamics is entering the human capital field giving rise to the model shift in the HR field (Barman & Das, 2018). HRM has been greatly challenged with the development of artificial intelligence technology (Jiang et al., 2018). AI has shifted the HR industry through improving the likelihood of producing and engaging an intelligent machine which functions like a human for human-like roles in the industry (Barman & Das, 2018). Jiang et al. (2018) suggest that HR managers need to shift their thinking in the era of the rapid progression of AI by fully recognising the influence of AI on HRM, striving to improve their own quality, meeting the trend of development, proactively stimulating their own imagination and passion and focussing on the exceptionality of humans.

The threat of competition due to resources could potentially become an inadvertent societal consequence of advancement in technology (Callaghan, 2018). Moreover, organisations' inability and reluctance to train and develop talent; capability to attract and groom skilled employees, retaining and utilising the existing employees resourcefully and skilled employees relocating have also exacerbated the 'war for talent' (Butcher, 2008; O'Callaghan, 2008; Greyling & Stanz, 2010). Stock and Seliger (2016) suggest three different sustainable tactics for surviving the social challenge associated with Industry 4.0; namely: (1) growing the training proficiency of workers

through a combination of novel ICT technologies such as virtual reality head mounted displays and learn-instruments; (2) growing intrinsic motivation and promoting imagination through novel CPS-constructed methods of work design and organisation, e.g. by applying the ideas of flow theory or utilising new ICT technologies for applying the concepts of gamification to encourage decentralised policymaking; (3) growing the extrinsic motivation by applying individualised incentive systems for workers, e.g. consideration of the smart data within the product life cycle for delivering mechanisms for individual response.

The McKinsey Global Institute study of 2017 assessed the potential of technical automation of occupations by disaggregating professions into essential activities reflecting a combination of 18 performance proficiencies e.g. cognitive skills, sensory vision, natural language processing and physical capabilities. The focus of the analysis of the McKinsey (2017) study which was on work activities instead of occupations, concluded that 49 percent of the activities for which people are remunerated are automatable. Furthermore, less than 5 percent of occupations are fully automatable, whilst 30 percent of tasks in 6 out of 10 existing occupations are fully automatable (McKinsey, 2017). However, the tempo and degree of automation of entire work activities and professions is not comparable due to technical feasibility differences, potential economic expansion and possible social implications of technology adoptions within and across several industries (Karacay, 2018). Although automation will not occur overnight, the 2017 study by McKinsey identified five key features that will affect the extent and pace of its adoption:

- Technical feasibility
- Cost of developing and installing solutions
- Labour market dynamics (including the demand, supply and costs of human labour as a substitute to automation)
- Economic benefits (labour cost savings)
- Regularity and social acceptance

The overwhelming pressure to globalise has left South African enterprises with no option but to modernise through innovation, to boost competitiveness and their international appeal (Budhwar, Tung, Varma & Do, 2017). The significance of emerging markets globally means that the

“understanding about the dynamics of management of HRM in the emerging markets’ (Ems) context and the need for proactive efforts by key stakeholders (e.g., multinational and local firms, policymakers and institutions such as trade unions) to develop appropriate HRM practice and policy for Ems has now become more critical than ever” (Horwitz & Budhwar, 2015, p.1). Due to the erratic business environment, one of the difficulties facing many businesses is the growing perception that organisations require top-notch human resource capabilities and the processes for managing them to survive and thrive in this global economy (Armstrong, 2002). The successful execution of Industry 4.0 is reliant on its reception and incorporation into existing systems of firms (small, medium, and large), and the ability of the workforce to adjust to the potential changes it affords firms (Fantoni et al., 2018).

2.5 Talent management and the knowledge economy

The starting point to defining the concept of talent within a business context is by identifying the various components that comprise talent in a rapidly changing business environment (Harari, 1998). Selection criteria for individuals who can participate in talent management programs include being skilled and decision-making responsibilities within an organisation (Ariss, Cascio & Paauwe, 2013). In practice, such an elitist attitude to talent management in organisations excludes employees at a lower rank, such as the technical and operational teams who do not have the prospect to amass the various forms of capital (Ariss et al., 2013). In doing so, organisations could miss the opportunity to develop talent with instrumental roles in fields such as innovation, management and technical expertise (Ariss et al., 2013). Talent in the new economy is defined as innovative thinking, technical ability and high levels of customer service (Smith & Ruup, 2004). Furthermore, workers will be required to be globally astute and operationally agile to meet the new demands of the contemporary workplace (Smith & Ruup, 2004). Drucker (1969) refers to individuals possessing these skills for the new economy as knowledge workers.

Knowledge workers are described by Davenport (2005) as those with extensive expertise, education and experience who are primarily involved in creating, distributing or applying knowledge. Knowledge workers are employees whose means of production have shifted from labour to the productive use of knowledge and comprise the bulk of the talent core in organisations

(Drucker, 1969; Davenport; 2005). Knowledge organisations stress the impact that workers' knowledge and skills have on organisational achievement, and turnover is critical as individuals' talents are not transposable (Stone & Deadrick, 2015). The talent core of an organisation is the top performing ten to fifteen percent of people, as defined by the company (Harari, 1998). Karacay (2018) refers to talent in broad terms as people having the skills, intellect and capability required of a vocation that allows for performance of specified tasks at a superior level. Organisations need to identify their competence gaps, fill them efficiently whilst considering the aspirations of their employees and plan accordingly (Kravčík et al., 2017).

As organisations expand operations into foreign countries and become global players, they seek to hire skilled people in competing firms (Elegbe, 2010). The impact of globalisation therefore has implications for how and when people work and the demographic, economic and societal moves along with technological developments are constantly transforming the way people function and are managed (Fox, 2010). Due to increasing change, complexity and competition, innovation is viewed as a key talent requirement (Tucker, 2001). Organisations that want to gain sustainable competitive advantage must develop strong competencies in acquiring, developing and retaining human capital and knowledge (Drucker, 1999). Furthermore, organisations wishing to compete in the market require an understanding of the knowledge, skills, behaviours and attributes that characterise talented employees (Drucker, 1999). Organisations constantly need to seek competitive advantage; testing new practices, models and keeping abreast of the latest trends. Wellins, Smith and Erker (2009) argue that most competitive advantages like technology, practices and processes can be adopted by competitors. To maintain competitive advantage, organisations have looked at numerous sources of advantage (Abraham, 2011). One common source identified as a competitive advantage is talented individuals and those employees who have scarce skills (Abraham, 2011). Talent management contributes to the eradication of waste of organisations and supports self-development of its employees (Karatop et al., 2014). According to Douthitt and Mondore (2014) one question that intrigues scholars in the HR field is: how to leverage the influence of analytics on the large employee data for strategic policymaking in talent management.

Talent management emerged as a modern-day component of human resource management from the mid-1990s onwards (Tarique & Schuler, 2009; Sahai & Srivastava, 2012; Altmöz, Cakiroglu

& Cöp, 2013; Gümüs, Apak, Gümüs & Kurban, 2013). Gümüs et al. (2013) state that the need for talent management is motivated by factors such as increased global competition, fast evolving technologies and the massive growth of emerging markets, thus it is considered as a parallel evolution in human resource management, specifically as a synonym for HR 2.0. Talent management refers to employing the correct individual at the correct place and correct time (Gümüs et al., 2013). Moreover, it comprises identifying, developing, appraising, deploying and retaining high-performers and those with high potential within a particular field of work (Sahai & Srivastava, 2012). The barrier between the desired level of competences and the existing capabilities of the human resources is reduced through talent management which aims to address the gap and reveal the desired employee profile (Karatop et al., 2014).

Minbaeva and Collings (2013) suggest that talent management is a prominent term in managerial and HRM practitioner lexis since declarations of a War for Talent in the late 1990s. The phrase the 'war for talent' is described as the challenge faced by firms in the attraction, recruitment and retention of experienced and skilled personnel (Agrawah & Swaroop, 2009; Barton, 2014). The interest in talent management as a corporate strategy was introduced in the 1990s by a group of McKinsey consultants who coined the phase 'war for talent' (Khilji, Tarique & Schuler, 2015). In their seminal research, consultants Michaels, Handfield-Jones and Axelrod (2001) of McKinsey & Company showed that organisations that scored in the top quintile of their talent management index typically earned 22 percentage points on higher return to shareholders than their industry peers. The McKinsey study emphasised the critical role of human capital to the accomplishment of top performing organisations (Michaels et al., 2001). The 'war for talent' phenomenon has become the contemporary mantra of human resources professionals in the corporate world and will prevail for the future (O'Callaghan, 2008; Merita, 2011). Organisations cannot afford to be complacent about talent management as evidence suggests that talent shortages will be the hallmark of the future (Lanvin & Evans, 2013). Recognising demographic global changes such as the generational divide and interconnection of talent shortages, is vital for state legislators (Khilji & Keilson, 2014; Khilji, Tarique & Schuler, 2015) to develop integrated global talent management strategies so as to compete for talent (Lanvin & Evans, 2013).

According to Farndale et al. (2010) the role of globalisation and the rise in technological advancement have highlighted the necessity for a strategic mindset in HRM, particularly talent management. Furthermore, Aguinis, Gottfredson and Joo (2012) state that commercial growth and competitiveness in the modern economy is determined by management revolution, levels of free enterprise and high-level skill contributions. Almost seventy percent of an organisation's worth is dependent upon the experience and skills of its employees (Snell, 2011). Human capital is viewed as an essential strategic source for competitive advantage, as the distinction stems from the inimitable talents of the individuals in a company (Holland, Sheehan & De Cieri, 2007; Aguinis et al., 2012). The survival and triumph of many organisations is dependent on their capacity to attract and employ a competent and capable labour force prepared to operate in today's unpredictable and fiercely competetive environment (Chhabra & Sharma, 2014). People thus remain the most critical resource and core competencies of businesses, and their development therefore forms an exceptional and non-imitable competitive advantage (Ellis, Nyuur & Debrah, 2015).

A report by Mckinsey's Global Institute (2017) estimates that between 400-800 million individuals may be displaced due to automation by 2030, thus requiring these individuals to change job types and learn new skills. Furthermore, Acemoglu and Restrepo (2018) found that for each additional robot in the USA economy employment is reduced by 5.6 workers. Each supplementary robot to the workforce per 1000 human employees causes incomes to drop by 0.25 to 0.5 percent (Acemoglu & Restrepo, 2018). Automation is expected to lead to a massive reclassification and rescaling of work but the replacement of workers performing routine, methodical tasks, machines will promote the comparative advantage of employees with creativity, empathy, EQ, leadership and problem-solving skills (PricewaterhouseCoopers, 2017). There is a need for re-education and upskilling of the workforce but that requires employees to be motivated to embrace change, possess the required metacognitive competences for professional development and recognise and trust the results offered by machines (Kravčík et al., 2017). Organisations that can transform the growth initiatives of human capital into a foundation of competitive advantage are termed Branded Talent Developers (Younger, Smallwood & Ulrich, 2007).

The workforce of the primary and secondary industrial revolutions was classified as labour-intensive workers as opposed to the current generation of data knowledge workers of the information age (Liu, Huang, & Zhang, 2018), also referred to as digital natives (Hee & Shanmugam, 2019). Representatives of the future workforce need to explore and adopt some of the novel techniques and tools that react well to employee engagement as it is amongst the imperative indicators of an operational HR system (Nowacki, 2015). The use of big data and AI to predict future behaviour has made it a popular instrument for HR professionals for all facets of work planning (Hee & Shanmugam, 2019).

One of the limitations of concentrating on current significant people and positions in talent and succession management is that industry and business trends may be neglected – trends in fast-paced industries may imply a need for new categories of positions and people in the future (Sturgis, 2016). Ployhart and Moliterno (2011) connect the micro or individual-level features of talent management associated with knowledge, skills and abilities, with the macro or organisational-level features associated with strategy, education, organisational knowledge and experiences that are leveraged to develop the organisation.

2.6 The role of government in Industry 4.0

Reflecting on the buzz around the 4IR, Van Heerden (2018) learned of the term Humanity 4.0 on a visit to Singapore. The current digital divide in the modern era is such that the manner in which humans interact with each other has changed whereby there is contention of two cultures, the sciences and the humanities (Industry 4.0 and Humanity 4.0 respectively) (Van Heerden, 2018). According to Van Heerden (2018), the questions that need to be considered are as follows:

- How will the 4IR help to alleviate the challenges faced by the marginalised such as inequality, poverty and unemployment?
- In a world where history shows that humans are prepared to kill for limited resources, how will the 4IR assist in addressing such realities?
- How will human intelligence evolve with the advent of the 4IR?
- Does our development as humans prepare us to participate in the 4IR?

- What must contemporary tertiary institutions do to address the challenges associated with the 4IR?
- How can tertiary institutions adapt their current offerings to prepare their students for the new world of work?
- What is the role of critical theory in this era?

Some of the questions posed by Schwab (2016) highlighting the impact of technological innovation on the future of our societies are:

- How will the 4IR impact education, the healthcare sector and many other industries?
- How can the role of government be repurposed in the 4IR to encourage transparency in economic, environmental and social reform?

One of the most concerning aspects of Industry 4.0 for government is how technological innovation and inventions (e.g. robots and AI) could affect the labour market, and the resulting social implication for society. "Populations in the Global South may face a growing digital divide in comparison to the Global North, from and across which multinational firms bridge and draw resources and profits" (Callaghan, 2016, p. 63). According to Ellis et al. (2015), it is worth observing that characteristics and contextual factors of HRM in Africa and diversity are important to understanding employment and work in South Africa.

To reduce inequality, and avoid secular inertia, governments must recognise the pace and direction of technological transformation and strategise for the future (Frey & Osborne, 2015). Institutional and government factors are core to the functioning of HRM in multinational corporations and how it is valued and shaped (Budhwar et al., 2017). The way human capital is controlled within organisations is institutionally grounded in national contexts (Shipton, Budhwar & Crawshaw, 2012). Industry 4.0 places people at the core of production and workers will therefore be dispensed where support is required (Morrar et al., 2017). The new workplace requires more short interventions that are conceptualised 'on-the-run' to develop the specific skills workers require to apply unfamiliar disruptive technologies to innovative projects (Hattingh, 2016). The South African context is unique due to its high rate of unemployment, dramatic inequality, which

displays the technological divide between the Global North and the Global South, where knowledge creation and technology could, through universal management practice, be intensifying inequality (Callaghan, 2016). Stone & Deadrick (2015) reason that employees in possession of exceptional abilities and skills are important in knowledge organisations as the current professional requirements have led to a scarcity and subsequent competition for unique talent in many fields such as software engineering and nursing. In addition, changes in the economic environment have caused the displacement and redundancy of individuals who do not possess the requisite skills for knowledge-oriented roles (Karren & Sherman, 2012; Bell, Berry, Marquadt & Green, 2013).

At the end of 2014, the South African government was the largest employer with approximately 2.69 million employees (Development Policy Research Unit, 2016). Government is the primary consumer of IT products and services (State Information Technology Agency, 2016) and must therefore be equipped with the necessary intelligence to envision and endorse bold policies that create and shape technologies (Balkaran, 2017). In 2018, the President of South Africa, Cyril Ramaphosa appointed a presidential commission, coordinated by the Department of Telecommunication Services (DTPS) to develop a state strategy for South Africa to address the challenges associated with the 4IR (Lekhanya, 2019). South Africa's Communications, Telecommunications and Postal Services Minister, Stella Ndabeni-Abrahams believes that digital technologies could generate in excess of R5 trillion in value for consumers, industry and society at large (South African Government News Agency, 2019).

A keynote address titled "creating jobs together as we prepare for the future of work and the 4th industrial revolution" was made at the 24th NEDLAC Annual Summit held on the 26th of September 2019 by the South African Minister of Employment and Labour, Thulas Nxesi. According to the minister, although the National Development Plan (NDP) aims to address South Africa's challenges of inequality, poverty and unemployment, through job creation and stimulating economic growth, economic growth has underperformed whilst the unemployment rate has increased since 2012 (Nxesi, 2019). Furthermore, the government is aware that at the national level, job creation needs a stable macroeconomic framework as well as structural policies that stimulate innovation, business and skills development. Some of the initiatives by government to stimulate economic growth and job creation are as follows (Nxesi, 2019):

- The Business Process programme which is a partnership between business and government created 11,167 jobs in 2018 and 3321 between 1 January 2019 – 31 March 2019.
- Greater alignment in the Temporary Employee/ Employer Relief Scheme (TERS), implemented by the Commission for Conciliation, Mediation and Arbitration (CCMA), supported by the Unemployment Insurance Fund (UIF) and the Skills Education Training Authorities (SETAs), to aid organisations in distress during possible retrenchments and/ or short time or layoffs.
- The National Youth Service which was introduced in 2018 aims to assist young entrepreneurs working in sectors linked to new technologies.
- The Jobs Fund encourages partnerships between the private, public and non-profit sectors to identify innovative job creation models that can be scaled-up.

Education and human capital are at the centre of the knowledge economy (Teloni, 2018). South Africa has a low supply of scarce skills from tertiary institutions (Flores-Araoz & Furphy, 2012). Academic institutions have long been regarded as the primary place to pursue progressive ideas and new evidence suggests that job incentives and subsidy conditions in tertiary institutions currently favour incremental, conventional research projects over bold, ground-breaking ventures (Schwab, 2016). To foster radical and state-of-the-art technical revisions across academic circles and organisations alike, governments need to apportion more aggressive subsidies for ambitious research projects (Foster, Rzhetsky & Evans, 2015). By the same token, public-private research associations ought to gradually be designed towards knowledge creation and human capital to the advantage of all participants (Schwab, 2015). In the long run, investing in skills is far less costly than forfeiting the value of lower incomes, poorer health, social exclusion and unemployment, all of which are associated with subordinate skills (Teloni, 2018).

2.6.1 Government and skills development

The 4IR has redefined the workplace whereby new skill sets are required by organisations of the future, which poses a challenge to HR as they operate in a complex, evolving, interconnected and unpredictable environment (Tarry, 2018). According to Buller and McEvoy (2012), human capital

is a combination of the knowledge, skills and abilities possessed by labour. The South African government promotes continuous training and development of its entire labour force by promulgating the Skills Development Act No. 97 of 1998. This legislation is aimed at, among other objectives:

- To deliver an institutional framework for the formulation and implementation of national, industry and workplace approaches for the development and advancement of skills of the South African labour force;
- Integration of workplace strategies within the National Qualifications Framework (NQF);
- Provision of learnerships leading to recognised occupational qualifications; and
- Provision of skills development financing through a levy-grant scheme and a National Skills Fund.

Skills policy needs coherence and cooperation across various platforms and levels of government and collaboration with the private sector, social stakeholders, parents and teachers (Teloni, 2018). According to Gowan (2012) these changes necessitate that countries amend their educational systems to overcome work demands for these new organisations. Education systems need to be reflective of the advances in the knowledge space and also redesigned to inspire lifelong learning (Lee et al., 2018). According to Teloni (2018):

> Key issues concern the development and management of a coherent skills strategy, the involvement of the private sector and social partners in the setting of curricula that are more relevant to labour demand, the splitting of financing responsibilities between government, students and their families and the private sector (p. 10).

Policymakers and governments may need to adjust to the rapid changes in the 4IR landscape by offering an empowering environment with safeguards and strategies that can direct a justifiable economic and social change for the future, and that harnesses the ability that these technologies hold for individuals and communities at large (Morrar et al., 2017). Governments such as China and India are enticing skilled diaspora and others to return home, such as Singapore, which has invested in education and the development of its citizens (Khilji et al., 2015). Ragazzi (2014)

suggests that these government-led policies are aimed at establishing strong ties between respective nations through human talent and stimulating economic growth through the upgrade of local capabilities and raising pioneering capacities of businesses. High levels of unemployment for individuals with limited education and training and a scarcity of high-skilled jobs are characteristic of the South African economy (Reddy, Bhorat, Powell, Visser & Arends, 2016). Nationally, data reveals a structural change to a service economy, indicating that the type of jobs available and the sectors in which people are employed are evolving (Reddy et al., 2016). In 2014, the sector which employed the largest number of workers was the Community, Social, and Personal services (23 percent), therefore one in four jobs in the marketplace was created by government (Reddy et al., 2016). This was followed by jobs in the Wholesale and Retails sector (21 percent), Financial sector (13 percent) and the Manufacturing sector (12 percent). In the National Skills Development Strategy (NSDS), the Department of Labour (DoL) in South Africa and the Sector Education and Training Authorities (SETAs) are committed to selecting and communicating critical skills for justifiable growth, development and equity (DoL, 2005). In its Framework for Identifying and Monitoring Scarce and Critical Skills, the DoL (2007) uses the following definitions to direct SETAs in their identification of skills shortages:

> Scarce skills refer to those occupations in which there is a scarcity of qualified and experienced people, currently or anticipated in the future, either (a) because such skilled people are not available or (b) because they are available but do not meet employment criteria (p. 6).

The transfer of information through traditional means such as lectures and the test format, does not improve an individual's cognitive capacity ranks of higher order thinking (Aoun, 2017). The knowledge dimension encapsulates concepts, facts, metacognition and procedures (Aoun, 2017) which is representative of a series of knowledge from concrete to abstract (Anderson, Krathwohl & Bloom, 2001). Metacognition is linked to information literacy which is a crucial element of intelligence (Aoun, 2017). According to Visser (2002), the four levels to human learning which are related to human adaptive behaviour are:

- Pre-programmed and genetically transferable from one generation to the next generation such as fight and flight.
- Inherited predisposition to attain vital abilities such as linguistic capability.
- Commonly perceived learning level involving deliberate acquisition of specific skills and knowledge e.g. attitude capacity, cognitive talent, knowledge acquisition, motor skills and verbal abilities.
- Transformed into a permanent disposition to relate with one's environment.

Visser (2002) suggests that true lifelong learning occurs at the fourth level of learning. A clearer understanding of user needs and objects require an advanced quality in personalisation and revision of learning and teaching experiences and cultivation of metacognitive skills (Kravčík et al., 2017).

Augmented reality (AR) technologies and wearable technologies (WT) can considerably improve the usage of the human senses in the acquisition of knowledge and training new skills (Kravčík et al., 2017). Metacognitive skills, such as Self-Regulated Learning (SRL) are critical for the success of lifelong learning (Kravčík et al., 2017). Furthermore, the authors assert that WT and AR could revolutionise skills training in the work environment, which allows immersive routine training such as capturing and the re-enactment of proficient performance. In the context of Industry 4.0, Ansari, Erol and Sihn (2018) define mutual learning as "a bidirectional process involving reciprocal exchange, dependence, action or influence within human and machine collaboration, which results in creating new meaning or concept, enriching the existing ones or improving skills and abilities in association with each group of learners" (p. 119). Scenario-based learning is an iterative and interactive process which utilises scenarios, organised descriptions of everyday problems and associated instruction, to support dynamic development and learning (Erol, Jäger, Hold, Ott & Sihn, 2016). Since nearly everyone will work with AI, governments, industry and institutions of higher learning must prepare the workforce for lifelong learning together (Lewis, 2018). The concept of Education 3.0 signals a paradigm shift from the outdated schooling models of yester-year (Education 1.0), through the accountability of teachers and school leaders in relation to students' learning (Education 2.0), to a more holistic approach to education which is best suited to the 21st century (Hipkins, Bolstad & Johnson, 2019).

South African tertiary institutions are integral to delivering post-matric education and guidance and also an area of strategic significance to the Department of Higher Education and Training (DHET) (Nundkumar & Subban, 2018) as they offer education and teaching to communities at large for the advancement of skills for commerce, industry and public sector groups (White Paper for Post-School Education and Training, November (2013). Educational institutions, government and the private sector are critical to developing appropriate curricula and helping youth develop the right set of skills (Banwari, 2018). Worldwide, educational programmes at the tertiary level are being customised to become more creative and aligned to the requirements of the 4IR, as findings indicate that programmes fail due to traditional and staid methodologies that do not embrace creativity and innovation (Oxford, 2019).

Educational establishments must respond to 4IR trends, to adapt their foundation to offer their learners with the requisite skills for future careers (Oxford, 2019). Oxford (2019) further states that upcoming job profiles and the skills required for future jobs need to be identified. Consequently, the effect of high-tech innovations on the labour market must be analysed (Eberhard et al., 2017).

2.7 Bridging the gap between education and employability

According to Sivaram (2019) top firms such as Apple, Google and Netflix are appointing individuals who possess the necessary skills that get the job done, regardless of attainment of an academic qualification. Prominent CEOs supported their views as follows:

- CEO of Apple Tim Cook highlighted how their company was started by a college drop-out and stated that colleges do not impart individuals with the requisite skills that business leaders require most in the workplace such as coding.
- CEO of Siemens, Barbara Humpton is of the view the minimum requirement of a four-year degree on a job requisition is merely to assist recruiters sift through applications to qualify a smaller candidate group, when nothing about the job requires a degree.

- According to the professional networking application, LinkedIn, many of the organisations considered most desirable to work for do not need individuals to have a college degree.

According to Chamorro-Premuzic and Frankiewicz (2019) business leaders and employers bemoan the skills deficiency between what students learn in college and job readiness for the workplace. The Economist reports that there is a distinct premium on education as witnessed in Sub-Saharan Africa where a college degree may boost earnings by over 20 percent due to the rarity of degrees, as compared to Scandinavia where earnings are boosted by 9 percent due to 40 percent of adults possessing degrees (Chamorro-Premuzic & Frankiewicz, 2019). The authors also suggest that employers attach a value to tertiary qualifications because they are a reliable gauge of an individual's intellectual competence. That said, tertiary institutions could improve the value of a qualification by equipping students with the requisite soft skills (Chamorro-Premuzic & Frankiewicz, 2019).

The minimum requirement for most jobs at multinational firms in Africa and globally, is a qualification from a recognised tertiary institution (Gamiet, 2015). However, possession of a tertiary qualification does not represent a person's ability to perform a job (Gamiet, 2015). That said, when hiring a new individual, a recruiter may base an individual's suitability for a role on their employment history, whereas factors such as extramural activities, internships and part-time jobs are considered for graduates with no work experience (Gamiet, 2015). A study by one of the 'big 4' auditing firms EY, found that vetting students based only on their academic achievement was a weak approach to recruitment, hence the firm adopting a different recruitment approach for their 2016 programs (Gamiet, 2015). Furthermore, the study by EY indicated that positive correlations exist between certain strengths and achievement in future specialised qualifications (EY, 2015). According to EY's Managing Partner for Talent, Maggie Stillwell (EY, 2015):

> At EY we are modernising the workplace, challenging traditional thinking and ways of doing things. Transforming our recruitment process will open opportunities for talented individuals regardless of their background and provide greater access to the profession. Academic qualifications will still be taken into account and indeed remain an important

consideration when assessing candidates as a whole, but it will no longer act as a barrier to getting a foot in the door.

The four core personal skills that EY (2015) has acknowledged as being invaluable in succeeding in the first professional position that have been incorporated into EY's 'The Future Ready' programme are commerciality, influence, leadership and networking.

2.7.1 Skills development and the world of work

A Future of Jobs Report indicated that by 2020, more than a third of the required skill set of most jobs will be inclusive of skills which are currently not yet seen as significant (World Economic Forum, 2016a). Furthermore, 65 percent of children now will be in careers that have yet to be developed (OECD, 2016). Further 2020 predictions by the WEF indicate that besides basic skills for ICT, the future workforce requires mostly cognitive skills (52 percent), systems skills (42 percent) and problem-solving skills (40 percent) (WEF, 2016). To perform effectively within the 4IR environment, workers must practice continuous learning, not only in their own occupations but in a broader perspective with an interdisciplinary outlook (Karacay, 2018).

According to the WEF (2016) Future of Jobs Report, in 2015, the top ten skills required from workers in order of importance are as follows:

1. Complex problem-solving
2. Coordinating with others
3. People management
4. Critical thinking
5. Negotiation
6. Quality control
7. Service orientation
8. Judgement and decision making
9. Active listening
10. Creativity

However, the projection for skills requirements for 2020 will shift as follows (WEF, 2016):

1. Complex problem-solving
2. Critical thinking
3. Creativity
4. People management
5. Coordinating with others
6. Emotional intelligence
7. Judgement and decision making
8. Service orientation
9. Negotiation
10. Cognitive flexibility

Moreover, for each work role, the skill sets required must be identified through relative studies that include benchmark submissions and past practices within and across sectors (Karacay, 2018). Ahrens and Spöttl (2015) highlight the parameters that are significant criterion of skilled employees in the 4IR: increasing digitisation of production systems, complete integration and data transparency, decision making and self-management by objects, digital communication and interactive management roles and flexibilisation of labour.

Some of the messages regarding scarce skills are open to methodological grounds (Erasmus & Meier, 2009). The pressures of tomorrow's world forces us to reassess what is meant by 'high skill' in the 4IR framework (Schwab, 2016). Tax bases are eroded with massive growth in unemployment as a result of the rise in robots and AI employed and thus encumbers the upgrade of the required infrastructure for the 4IR (Lee et al., 2018). The state and civil society must join forces to design a sustainable job ecosystem in response to Industry 4.0 (Arntz et al., 2016). In comparison to purely government-designed school curricula, workplace learning has several advantages: it offers the youth an opportunity to develop hard skills on updated equipment and soft skills such as communication, negotiation and teamwork, through practical involvement

(Teloni, 2018). Furthermore, continuous real-world experience in the workplace helps in motivating demoralised youth to remain or participate in education and to ease the transformation from the education system to the working world (Teloni, 2018). Although employers have a vital role in training their workers, small and medium sized organisations might require government support to offer such training and accomplishing such cooperation is a challenge in the Global North and the Global South alike (Teloni, 2018).

Firth (2015) suggests that labour unions also need to focus on this facet of technology transformation as continuation to employ the current 'slow change' strategy could put their membership at risk. The private sector should emphasise emergent technologies as the disruptive inventions that are vital and the state must underline backing basic research and generic technology for non-profit purposes (Lee et al., 2018). These changes have expansive consequences from individual life, to firm-level commercial strategy and public policy areas (Valenduc & Vendramin, 2017). The impact of the 4IR is such that at the societal level, the flexibility of the workers is critical to fully realising the advantages thereof; at the individual level the facility to enforce the transfer of the labour force is the pivotal aspect for the survival and growth of the organisation; and where knowledge management is concerned, the professional and tertiary education system should essentially be reorganised (Lee et al., 2018). Skills development has more impact when the learning domain and the world of work are related (Teloni, 2018). Furthermore, organisations need to consider what they could benefit by cooperating with customers, competitors, service providers and technology partners, without limiting the vision built on existing limitations (Sarvari et al., 2018).

2.7.2 The gig economy, multi-skilling and psychological contract

Booth (2019) posits that the gig economy has disrupted the idea of corporate culture, organisational loyalty and institutional memory, as it provides opportunities for organisations to capitalise on benefits, office space and training, thus leading to acquiring the best talent at an affordable rate. The gig economy is an assortment of markets whereby service providers are matched to clients on a gig (job) basis to provide on-demand commerce via a smartphone application or an internet-based technological platform (Donovan, Bradley & Shimabukuro, 2016). The gig economy is thus an extension of traditional freelance work as self-employed individuals create an income through

various jobs and projects (Donovan et al., 2016). According to the Head of Organisational Development and Human Resources at Investec, Marc Kahn, giggers are redefining the notion of a company as follows:

> But what if all the people employed in the company are employed as gigs? Where is the company? We start thinking about capability, and capability becomes detached from an individual and it becomes a commodity that's moving around in a free-flowing environment. People cluster together in sensible ways and then uncluster and reconnect in various gigs to deliver a very agile value chain…. Loosely coordinated by a leadership function without too much management control, but enough to manage the risk in a very fluid environment.

A LinkedIn report proposes that by the time Millennials are 30 years old, they will have held four jobs as job-hopping will be the 'new normal' (Booth, 2019). Careers have evolved from the outdated notion of a single profession for example doctors, lawyers and accountants, to that where individuals are increasingly employed in various specialised roles over the progression of their careers (Caza & Creary, 2016). The authors also suggest that today numerous professionals are not only attaining a set of specialised skills and knowledge, but rather accumulating various skill sets and utilising them in other ways. Caza and Creary (2016) suggest that organisations are now designing dual or hybrid roles aimed at bridging professional boundaries and duties within organisations. For example, many healthcare organisations are now making use of hybrid clinician managers who are expected to function in collective management and clinical positions aimed to bridge scientific and economic aspects (Braithwaite & Hindle, 2001; Ferlie & Shortell, 2001).

The Allan Gray Orbis Foundation (2016) indicates that the positive impact of the 4IR will be driven by the individual's agency and disposition to form the opportunities it creates for the good of humanity. An example of the opportunities of the 4IR for the betterment of humanity is that of South African born, Los Angeles based Dr Patrick Soon-Shiong who qualified as a medical doctor at the University of the Witwatersrand (Allan Gray Orbis Foundation, 2016). Dr Patrick Soon-Shiong who is now described as a billionaire biotech entrepreneur, inventor, philanthropist, physician, scientist, surgeon and technologist has dedicated his career to "translating science into

medical innovations with local impact" (The Planning Report, 2018). According to Dr Patrick Soon-Shiong, "There is truly a way to converge biology, medicine, artificial intelligence, cloud computing, physics and technology. In fact, we are actually already in this Fourth Industrial Revolution; we just don't know it." The Allan Gray Orbis Foundation (2016) describes the mission statement of Nantworks, an organisation founded by Dr Patrick Soon-Shiong, as "to cure cancer by using technology to fully sequence a person's genetic information in a matter of minutes enabling far more targeted treatment." Further examples of how breakthroughs made possible by the 4IR are illustrated through how Dr Patrick Soon-Shiong assists the blind to see through the process of 'machine vision' (Allan Gray Orbis Foundation, 2016).

Creary, Caza and Roberts (2015) suggest that organisations and professions can promote coactivation and complexity by embracing innovative role combinations and also inspiring individuals to be their authentic selves in the workplace as it allows for individuals to acclaim their diverse backgrounds, interests and other individualities deemed to be relevant and pertinent at work. The advantage is that individuals will be able to be active both at work, by not keeping certain identities at the door through inhabiting a single 'professional' cloak (Creary et al., 2015). Contemporary organisations thus have a role in assisting the modern workforce to find solutions to offset their professions with complementary professions with which to pair them (Caza & Creary, 2016). Modern day professions have changed such that individuals are being requested to function in multiple work roles thus allowing individuals to define a boundaryless sense of self and creating work experiences that are not confined to a single profession (Caza & Creary, 2016). Work identities are not bound to professional identities but are rather significances that individuals ascribe to themselves in the workplace context (Dutton, Roberts & Bednar, 2010).

Slay and Smith (2011) define professional identity as the impressions that an employee holds of themselves as a professional whereas Schein (1978) defines it as the combination of attributes, beliefs, experiences, motives and values that individuals use in defining themselves in their professional setting. Pratt, Rockmann and Kaufmann (2006) describe professional identities as a signal of the type of work an individual is engaged in which is often an indicator of the type of advanced training and skills the individual possesses whereas organisational identities are indicators of where an individual works. Professional identity has been pronounced from both an

identity theory and social identity theory perspective (Caza & Creary, 2016) where identity theory is described as the multiple identities (work and non-work) that are organised in a hierarchical manner according to their eminence (Stryker & Burke, 2000). According to Tajfal and Turner (1985), social identity theory involves how people categorise themselves and others through a variety of social categories. The assumption of research on how professional identity is created is that individuals are proactive participants in the construction of their professional identity and others involved in the social setting merely exist in a more passive role (Caza & Creary, 2016).

The world of work has evolved such that people no longer work for the same organisation for 25 years after which they are awarded a gold watch whilst receiving the benefits and security associated with fulltime employment (Friedman, 2014). Two years ago, Atlantic described the 'freelance surge' as the 'industrial revolution of our time' thus concluding that the upsurge in the gig economy is nothing revolutionary but merely a shift that is as significant and comparable to the transition from the agricultural to the industrial economy (Horowitz, 2011). The gig economy allows individuals to seek the best probable operational conditions and wages for themselves whilst promoting their skills and establishing a commercial venture for themselves (Friedman, 2014). Furthermore, gig work can be liberating as it releases the previously unexploited entrepreneurial vim of the American worker (Friedman, 2014). According to Carson (2012) the advantages of gigs are that they enable unemployed and underemployed individuals to progress their careers whilst also providing permanently employed individuals a chance to dabble in entrepreneurship before taking the plunge. Further advantages of being a gigger or 'sidepreneur' as outlined by Friedman (2014) is that:

- It allows determined individuals to revel in the prospect of structuring their personal time and career paths;
- Individuals can work to pay the rent whilst focussing on creating their personal job portfolio and developing their business plans;
- Young workers can escape the confining restrictions associated with traditional jobs;
- Entrepreneurship is also a feasible solution to underemployment and youth unemployment.

A snapshot of the Bureau of Labor Statistics (BLS) survey highlights that gig work is fairly common in sectors including business and professional services and financial services, which employ well-paid consultants and computer technicians who possess degrees from elite institutions (Friedman, 2014).

A degree is synonymous with employment and success, but students need to know that the course content and programs are authentic in content and assessment to arm them with crucial transferable skills, prepare them for work and future life choices (Bailey & Calonge, 2017). Upon graduating, college graduates pursue employment prospects that exploit their academic knowledge and intrinsic talents as they believe that they 'have what it takes' to succeed in the global market (Stewart, Wall & Marciniec, 2016). The reality from the employers' perspective is that the skills of most college graduates fall short of their expectations (Stewart et al., 2016). Equipped with a degree or other education, job seekers attempt to signal their quality to prospective employers through conveying valuable data reflecting their skills and abilities (Connolly, Certo, Ireland & Reutzel, 2011). Technological advancement and the evolving scope of corporate rivalry has changed the requirements for soft skills (Deepa & Seth, 2013) such that employers require applicants who possess cross-cultural literacy involvement in communication, economics, global awareness and ease of operating internationally (Gore, 2013). If employers are not 'signalling' to job seekers that certain skills are required, then graduates may not be aware they need to signal to prospective employers that they possess the requisite skills as the relationship expectations are not explicit (Stewart et al., 2016).

(Laukkonen, Biddell and Gallagher (2018) highlight that one of the primary goals of education should be to prepare learners to be adaptable by equipping them with meta-learning skills (Maudsley, 1980), subsequently that when the inevitable changes happen, communities and people can adopt new skills and effectually transfer knowledge across a multiplicity of situations (Laukkonen et al., 2018). As students prepare for life post-graduation, tertiary institutions are faced with questions about their own destiny, specifically employment (Xing & Marwala, 2018). Many higher education establishments are transforming their learning and teaching methods to equip scholars with the required dispositions, knowledge and skills that facilitate lifelong learning for the VUCA world, termed '21st century competencies' (Shum & Crick, 2016). Although

humanity has experienced infrastructure revolutions, it is unprecedented to the explosion of the internet, mobile computing and recently the internet of devices creating disruptions at an extraordinary pace (Shum & Crick, 2016). Although a complex, dialectical and exciting prospect, higher education in the 4IR (HE 4.0) has the potential to make a positive societal impact (Xing & Marwala, 2018). Research in education and on workplace futures conducted the Foundation for Young Australians (2016) and the World Economic Forum (2016), advocate for educational systems -primary school through to higher degrees- to develop from solely focussing on mastering knowledge and skills in a predefined curriculum whereby assessment is ordinarily under controlled exam conditions (Shum & Crick, 2016). The rapid pace of the 4IR has necessitated several types of institutional connections that are both domestic and international, to offer degree programmes and professional qualifications with greater versatility (Xing & Marwala, 2018).

Van Heerden (2018) is of the opinion that adapting to the new era requires a multidisciplinary education whereby humans and the social sciences understand science and technology and vice versa. According to McGrath (2015), country-specific skill sets are required thus creating a high-demand position to equip and skill the emerging labour force (Asvat, Bisschoff & Botha, 2018). According to Asvat et al. (2018) identifying and delivering country-specific skills is not the sole responsibility of educational policies and government, but also the role of private higher education to identify and engage in entrepreneurship to meet the market demand in South Africa.

2.8 Theoretical framework of the study

The theoretical framework that informed the study was developed by bodies of research on innovation management through disruption theory and understanding how the career process is shaped through the career development theory of chaos. To further address the study objectives, academic literature pertaining to vocational psychology such as the protean and boundaryless career models provided theoretical grounding for the study.

2.8.1 Disruption theory

The focus of radical innovation within innovation management has been on the evaluation of technological changes through observing the characteristics of new products and services and how

they have improved over time (Chiaroni, Chiesa, Chiesa, Franzò, Fiattini & Urbinati, 2016). The modern-day usage of the term innovation is similar to the way in which economist Joseph Schumpeter referred to it in 1939 in his work on business cycles (Bailey, 2015). Schumpeter described how organisations used innovation to produce new products, new processes and new organisational structures to existing or new markets (Bailey, 2015). The use of technology through access to AI-applications and digital platforms, allows small and medium sized businesses to delve into a vast reservoir of financing, information and skills that were previously only available to large corporations (PwC, 2017). The benefit of integrated version technology allows huge, data-driven corporations to capitalise on economies of scale thus causing fewer disruptors to penetrate the markets (PwC, 2017).

Christensen et al. (2015) define disruption as the development of a smaller company with limited resources effectively challenging established incumbent organisations. Recently, input from executives of disruptive technologies has focussed on anomalies whereby 'disruption' has not only changed competition in a given industry, but also an industry being 'disrupted' by an innovation introduced to the market by newcomers or an incumbent firm from another industry (Chiaroni et al., 2016). Information technology (IT) is an essential element of innovation as disruptive new combinations can emerge between technologies and markets (Lee et al., 2018). These new combinations are unexpected and uncontrollable and although they control the concrete directions and aspects between technologies and markets, they are unforeseeable and thus hard to predict (Lee et al., (2018). Lee et al. (2018) advocate for a definition of the 4IR that constitutes super disruptive innovation characterised by greater influence than the disruptive innovation of Professor Christensen in 1997, as industry 4.0 is anticipated to effect humans unexpectedly, which is outside the marketplace purposes of disruptive innovation. Industry 4.0 is expected to provide new forms of manipulation models and innovations, advances in quality and so on in businesses (Lee, 2018).

Disruption has been proposed as the framework for tackling social difficulties such as poverty, illiteracy, unemployment and lack of accessibility to healthcare (Hart & Christensen, 2002; Christensen, Grossman & Hwang, 2008; Christensen, Horn & Johnson, 2008; Christensen & Bever, 2014). According to McAfee, Goldbloom, Brynjolfsson and Howard (2014), although senior managers are far from obsolete, the rapid progression of machine learning requires

executives to become proficient in generating innovative organisational forms required to cope in an age of machine intelligence; leadership skills, heightening creative capacities and strategic thinking.

Disruptive innovation is an influential way of rationalising innovation-centric growth as owners of small entrepreneurial firms tribute it as their guiding foundation as do executives at established firms (Christensen et al., 2015). The theory of disruptive innovation by Christensen provides a warning on managerial myopia when decisions need to be made about new markets (King & Baatartogtokh, 2015). Although theories offer philosophic sagacity, they are no substitutes for critical analysis of competitors and the sources of competitive advantage (King & Baatartogtokh, 2015). Comparisons have been made between Christensen's theory of disruptive innovation and Schumpeter's creative destruction, which is a term from Marx, whereby old firms, products and industries were replaced by new products and business models in a capitalist economy (Schumpeter, 1942; Christensen, 1997; Lepore, 2014). The focus of Christensen's work on disruptive technologies investigated why some organisations failed whilst others survived through the 'creative destruction' process (Bailey, 2015). The nature of innovation radicalness is inherent in the transformation of traditional managerial practices, specialised complementary assets, performance dimensions of goods and processes and causes of rents due to innovation (Chiaroni, Chiesa, Frattini & Turba, 2010).

In innovation theory and practice, the Triple Helix model has often been used as a substitute to the 'innovation systems' concept, first introduced in the mid-1980s to appreciate economic growth and innovation in evolutionary systems wherein institutes and learning methods are of chief importance (Freeman, 1987, 1988; Freeman & Lundvall 1988). The underlying philosophy of the Triple-Helix (TH) concept is synergy through cooperation whereby knowledge spaces are created via inter-related roles of engagement with academia, business and government as TH actors (Steenkamp, 2019). Ranga and Etzkowitz (2013) used the systems theory (Carlsson & Stankiewicz, 1991; Carlsson, Jacobsson, Holmén & Rickne, 2002; Edquist 2005; Bergek, Jacobsson, Carlsson, Lindmarki & Rickne, 2005) to define Triple Helix systems as a set of: (1) components (the institutional spheres of Government, Industry and University, with a wide range of actors); (2) relationships between components (collaborative leadership, collaboration and

conflict control, substitution and networking); and (3) functions, described as processes that occur in what is called the Knowledge, Innovation and Consensus Spaces.

The vision of the TH concept not only encompasses creative destruction (Schumpeter, 1942) as a natural innovation dynamic, but also the creative regeneration arising within the spheres of government, industry and university respectively, including their intersections (Ranga & Etzkowitz, 2013). Industry 4.0 is anticipated to deliver novel forms of manipulation models and innovations, developments in quality in businesses (Lee et al., 2018). In view of the importance of disruptive innovations in both emerging and advanced economies, greater consideration of how the pursuit of opportunities can result in disruptive innovation is required (Hang, Garnsey & Ruan, 2014).

2.8.2 Career development theory of chaos

The rise of automation and machines has the potential to diminish the pursuits that are meaningful and bring purpose to the lives of many workers through their careers, personal passions and their way of life (Laukkonen et al., 2018). Given that we live and work in a VUCA world (Rodriguez & Rodriguez, 2015), Wong and Rasdi (2015) advocate for substantive transformation in the employment relationship and the psychological contract between individuals and organisations in a world characterised by job insecurity and drastic work environments. Individuals must thus manage their careers and update their knowledge and skills to make them appealing to potential employers (Hall & Chandler, 2005). Employees are forced to navigate uncertainty and indeterminate employment through adapting to occupational transitions, flexibility and lifelong learning; therefore, preparing for possibilities rather than making plans (Savickas, 2013). According to Savickas and Porfeli (2012) career adaptability is a representation of an individuals' faculties to cope with current and anticipated responsibilities, transitions, traumas in their occupations and consists of four dimensions:

- Career concern - developing a future orientation to work and feeling optimistic about it;
- Career control - developing self-regulation for engagement in vocational tasks and transition processes;

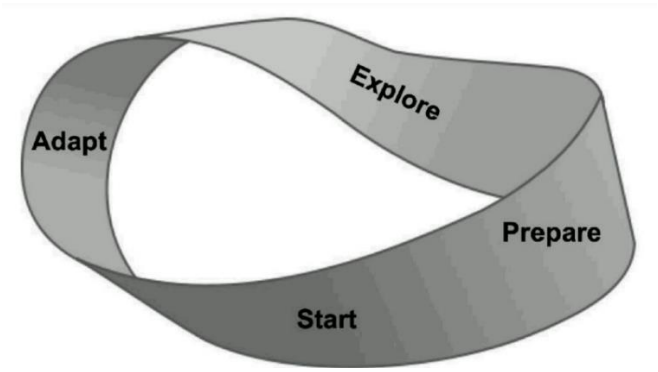
- Career curiosity - being inquisitive about work, openness to new experiences and experimenting with future possibilities; and
- Career confidence - obtaining and enhancing self-efficacy to pursue ambitions and execute a plan of action for the implementation of educational and career choices (Hartung, Porfeli and Vondracek 2008; Savickas 2013; Savickas and Porfeli 2012).

Career research within the last twenty years suggests that adaptive, proactive and self-managed attitudes and methods are required for contemporary careers in order to handle the increase in ambiguity, flexibility and boundarylessness nature of work (Gubler, Arnold & Coombs, 2014). Academics, human resources practitioners and consultants have therefore developed a need to assess new career orientations to assist in identifying, developing and managing talent (Baruch, 2014). Uy, Chan, Ho, Sam and Chernyshenko (2015) posit that the emphasis of career development in the 21st century has evolved to career adaptability where the focus is on the career choice of an individual in developing themselves into what they want to be, as opposed to the past century where individuals were assisted in deciding on a job, occupation or vocation. However, Rodrigues, Guest, Oliveira and Alfes (2015) view career development as a complex process that involves the individual and the organisation in a mutually beneficial relationship in the development of employees. Arthur, Hall and Lawrence (1989) describe a career as a sequence of an individual's work experiences which have developed over time. Baruch and Rosenstein (1992) define career as the development process of an individual "along a path of experience and jobs in one or more organisations" (p. 478). Sullivan (1999) states that although careers were initially limited to one or two organisations, the current workforce are overcoming organisational barriers through building careers that transcend numerous divisions, industries, locations and organisations. Sullivan (1999) further suggests that the eradication of managerial layers has led to blurred lines of hierarchical career paths leading to the pursuit of different career types to achieve career success, which necessitates new models of career systems which change in accordance to the organisational change with their environments (Nishanti, 2016).

In career development theory, the chaos theory of careers (CTC) by Pryor and Bright (2011) is indicative of the reality of contemporary career development pertaining to the evolving nature of work, signalling a shift in career development concepts in the last twenty years and a drastic change

to the world of work (Schlesinger & Daley, 2014). According to Krumboltz (2009) the purpose of career counselling is to assist and prepare clients to take action not merely to make one professional choice, but through providing tools for lifelong career development (Schlesinger & Daley, 2014). A depiction of the Mobius strip (Figure 2.1) demonstrates a set of unique features of the CTC and relates it back to its mathematical origins (Schlesinger & Daley, 2014). Mobius strips are known as a metaphor for change, for example the universal symbol for recycling (Schlesinger & Daley, 2014). Furthermore, they have everyday applications in engineering, mathematics, literature, music and science (Pickover, 2006). The Mobius strip is a visual representation of Arthur and Rousseau's (1996) boundaryless concept as the surface has one side and one edge and is thus non-orientable and boundaryless (Pickover, 2006). The phases along the Mobius strip therefore represent the movement and nonlinearity of the CTC model which, like a career which does have a linear path, does not have a true starting or finishing point (Schlesinger & Daley, 2014). As with the acronym EPSA (explore, prepare, start and adapt) which is merely used to help one recall the phases of the model, a required starting point is not shown (Schlesinger & Daley, 2014). Furthermore, the Mobius strip demonstrates the repetitive and complex patterns that influence the career decision making process whereby chance events that take place create detours that allow for the development of new complex routes (Schlesinger & Daley, 2014).

Figure 2.1: Mobius strip representing the CTC model



Source: Schlesinger & Daley (2014)

A single job in an organisation can be viewed as a single set of interconnected constrictions (on a system), similarly an individual's career or work history can be viewed as a more complex system (Bright & Pryor, 2005). According to the CTC, a shared theme is patterns within patterns

(Kauffman, 1995). Valuing how these patterns function at differing levels of complexity and generality has given rise to the mathematical concept of 'the attractor' being adopted in CTC (Bright & Pryor, 2005). Attractors are described as the restraints on the operation of a system as it influences behaviour by drawing it in certain directions (Bright & Pryor, 2005). The four main types of attractors that are generally known in CTC are as follows:

- Point Attractor – which describes behaviour when the object of focus (a person or a thing) is attracted to a specific thing e.g. person-environment fit models of career decision making are examples of point attractions (Dawis & Lofquist, 1984; Holland, 1959).
- Pendulum Attractor – which constrains behaviour to a regular, particular pattern e.g. a job seeker who is undecided between two career options (Bright & Pryor, 2005).
- Torus Attractor – which describes complex behaviour that is ultimately constrained and repeated e.g. employees who perceive their careers as changing and varied whilst simultaneously feeling bored or stuck in a rut due to an endless routine job (Covey, 2004).
- Strange Attractor – which typically used to characterise chaos models as it is the most complex and counterintuitive e.g. identifiable and psychometrically assessed skills and traits of individuals (Bright & Pryor, 2005).

Throughout the 20th century, the most popular career counselling approach of matching the interests and abilities of the client to a particular career was based on Parsons (1909) seminal trait and factor approach (McMahon & McMahon, 2006). Although the trait and factor model is widely used in career counselling (McMahon & Patton, 2006), critics suggest that contemporary career paths are more complex necessitating broader counselling approaches (Borg, 2015). Some of the criticism of the person to job matching approaches are that it is insufficient, simpleminded, limited and oversimplified (McMahon & Patton, 2002); Savickas, 2005; Pryor, 2006). According to Krumboltz (1998), Parsons' (1909) theory assumes that occupational choice is a rational course without room for chance or unplanned events like the Chaos Theory of Careers by Pryor and Bright (2003b). Stacey, Griffin and Shaw (2000) view CTC as considering change, creativity and crisis within organisations in management literature. Furthermore, CTC provides an all-encompassing justification of human behaviour within organisations and the conduct of said organisations, unlike

traditional systems approaches that are conceptually and virtually flawed in approach and scope in management theory (Stacey et al., 2000).

2.9 Protean and boundaryless career models

Globalisation has resulted in dilemmas such as the changing cultural, economic, political and social environments which impacts how workers function and manage their professions (Amundson, Mills & Smith, 2014; Lyons, Schweitzer & Ng, 2015). The modern career environment is thus turbulent and stressful (Lyons et al., 2015). Furthermore, the traditional linear organisational careers of yester-year are outdated as modern boundaryless careers are self-directed, and values driven placing the onus on individuals to take ownership for their career progress (Amundson et al., 2014). The concepts of the protean and boundaryless career thus holds ongoing and in theory greater importance in a largely digitised and digitised economy (Hirschi, 2017) where the new psychological contract emphasises continuous learning opportunities, personal autonomy and self-awareness (Chin & Rasdi, 2014).

The protean career entails individuals managing their career opportunities and career choices (Chin & Rasdi, 2014). The notion of protean career relates to the boundaryless career to a certain extent as the boundaryless career describes an individual's physical and psychological mobility between various occupations and organisations (Chin & Rasdi, 2014). The developing dynamism of today's world requires fluid and adaptable individuals particularly in the rapidly changing career climate (Hall, 2002; Fugate, Kinicki & Ashforth, 2004). Environmental pressures and constraints have influenced development in the protean career such that employees have heightened self-awareness, exploration and sensitivity towards these externalities (Chin & Rasdi, 2014). The behavioural actions include experiences of self-feelings, information exchanges, grasping and the mastering of competency skills and the achievement of gratification in life and work, which is the emphasis of the protean career (Chin & Rasdi, 2014). The 4IR might lead to a record increase in industrial, social and technical innovations, thus casting aspersions on the adaptive capabilities of people and organisations in relation to pressures to economic security, human identity and social stability (Morrar et al., 2017).

There is an impression that an worker's employability includes a multitude of person-centred constructs required to deal with the job-related changes occuring in the current economy effectively (Fugate et al., 2004). Sullivan and Baruch (2009) suggest that the most prominent career models to address the advent of new careers that have arisen in the last three decades are the protean (Hall, 2004) and boundaryless career models (Arthur & Rousseau, 1996; Arthur, 2014). The concept of the protean self refers to Proteus, known as the Greek god of many forms and is described as follows:

> We are becoming fluid and many-sided. Without quite realizing it, we have been evolving a sense of self, appropriate to the restlessness and flux of our time. This mode of being differs radically from that of the past. . .We feel ourselves buffeted about by unmanageable historical forces and social uncertainties. . .our behavior tends to be ad hoc, more or less decided upon as we go along. . .But rather than collapse under these threats and pulls, the self turns out to be surprisingly resilient. . .We find ourselves evolving a self of many possibilities (Lifton, 1993, p. 1).

The protean career has arisen as a popular concept in the 21st century (Cappellen & Janssens, 2008). The protean career is defined as individuals taking greater accountability for their career choices and career prospects (Chin & Rasdi, 2014) and Hall (1976) describes it as a process whereby the individual proactively manages their career in accordance to their value systems. The protean career is such that the evolving landscape of a competitive work atmosphere places the onus on workers to manage their career development and not depend on the organisation (Wong & Rasdi, 2015). In recent times, swift developments in the business environment have given rise to individual career development and management (Greenhaus, Callanan & Godshalk, 2010). McElroy and Weng (2016) view the protean career as continuous learning and development and psychological accomplishment as opposed to monetary awards and the vertical rise up the corporate ladder and monetary rewards. A protean career attitude is one that refers to the inclination of an individual to enact a career focussed on attaining subjective success through self-governed career organisation (DiRenzo, Greenhaus & Weer, 2015; Supeli & Creed, 2016). The developing dynamism of today's world requires fluid and adaptable individuals particularly in the rapidly changing career climate (Hall, 2002; Fugate et al., 2004). Environmental pressures and

constraints have influenced development in the protean career such that employee's have heightened exploration, self-awareness and sensitivity towards these externalities (Chin & Rasdi, 2014). Furthermore, the focus for the protean career involved behavioural actions which include experiences of self-feelings, information exchanges and attaining fulfilment in both life and work (Chin & Rasdi, 2014). Hall & Mirvis (1995), refer to the 'protean worker' and contend that in order to be effective within the modern working environment, workers are required to be increasingly adaptable and proficient at handling multiple identities.

The notion of career identity resembles concepts such as occupational identity, role identity and organisational identity as they all specify how individuals choose to express themselves in a given work setting (Fugate et al., 2004). The increased pace of change at work has led to the blurring of limitations between jobs, organisations and life roles (e.g., leisure, parent) and individuals are thus obliged to convey a greater number and selection of role transitions (Ashforth, 2001). A career identity essentially provides an articulate depiction of often varied and verbose career experiences and aspirations (Fugate et al., 2004). Factors such as beliefs, norms, and values; interaction styles, goals, hopes and fears; personality traits, time horizons; and so forth, may be considered in addressing the question 'who am I?' (Fugate et al., 2004).

Likewise, the cognitive-affective description of career identity combines further distinct differences such as dispositions, knowledge, skills and abilities that encompass employability and enable the recognition and realisation of career prospects (Fugate et al., 2004). Career identity is considered vital in aiding individuals to navigate the fluctuating boundaries of present-day careers (Hall, 2002; Fugate et al., 2004; Briscoe & Hall, 2006). LaPointe (2010) describes career identity as the articulation, enactment and negotiation of identity positions to narrate career experiences. The use of positioning locates identities within specific cultural, historic and interactional settings through the dissertations and master accounts that position identity. Furthermore, it facilitates the opportunity for individual input and change via the reflexive capability to revise and convey the available competing positions. In comparison to organisational and professional identity, career identity is not associated with a role or place but derives its significances from the classifications of work-related experiences (Fugate et al., 2004). It thus offers greater flexibility in identity

construction through defining who one is and how one should respond to the shifting vocational setting (Fugate et al., 2004; Ashforth, Harrison & Corley, 2008).

Fluctuations in social, economic and technological domains are influencing organisational flexibility and receptiveness in addressing competitive universal marketplace requirements (Chin & Rasdi, 2014). There will be complex demands in the labour force for skills in the management of multipart projects, however more flexible work will also be obtainable (Morrar et al., 2017). Modifications to the employment psychological contract and the career landscape have driven individuals to be more proactive in managing their personal career development rather than leaving it to their respective organisations (Chin & Rasdi, 2014). The concept of proactivity is essential to develop protean careers (Hirschi, 2017). The boundaryless career orientation entails the individual's readiness to explore career prospects and relationships across organisational boundaries (Briscoe & Hall, 2006). Individuals could be directed by independence, inner-directed decisions and crossing organisational boundaries in employment mobility (Chin & Rasdi, 2014). The boundaryless career is one of dependence from traditional organisational career arrangements that involve career opportunities that transcend single employer settings (DeFillippi & Arthur, 1996). The new notion of the boundaryless career no longer pertains to changing jobs within or between organisations over a career, but rather working for several employers in various projects in a short sequece, or even in parallel (Hirschi, 2017).

The characteristics of contemporary careers are that of a boundaryless career setting and dynamic labour markets whereby new career approaches and orientations have emerged thus making their evaluation a challenge (Baruch, 2014). Careers and the management thereof are part of any HRM system and are thus of interest to HRM scholars and practitioners (Baruch, 2014). The ideas of the protean and boundaryless career holds ongoing and potentially increased importance in a principally digitised and automated economy (Hirschi, 2017). Although the protean career model highlights that the individual and not the organisation, is in charge of career development (Hirschi, 2017), some companies realise that HR development practices assist individuals in their career development and have thus aligned individual career development and organisational career management (Chin & Rasdi, 2014). A bigger role may therefore need to be assumed by platforms of digital matchmakers (Evans & Schmalensee, 2016) that match job seekers and potential

employers, or existing employees to new job opportunities within the organisation (Hirshi, 2017). Both parties therefore play a vital role by presenting statistics about job requirements or personal skills, respectively, and delivering a positive online reputation to secure a suitable match enabled by such platforms (Hirschi, 2017). Although protean and boundaryless careers are relevant to the workplace, the specific components of what they constitute might need to be somewhat aligned to new realities (Hirschi, 2017).

2.10 Summary of the chapter

This chapter presented a critical review of literature that provided the theoretical groundwork for the study. The chapter explored and discussed the concept of the 4IR, its drivers and the role of artificial intelligence as it affects jobs in the labour market. The chapter then examined the impact of Industry 4.0 on human resources management. Thereafter, talent management was examined within the context of the 4IR. The role of government within Industry 4.0 and their role in skills development was also discussed. Bridging the gap between education and employability was also discussed with focus on skills development for the world of work, the gig economy, multi-skilling and the role of the psychological contract. The theoretical framework for the study was discussed with focus on disruption theory and the chaos theory of careers. Finally, the protean and boundaryless career models were discussed. The following chapter explains the research methodology that was employed in the conduct of this study.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology that was adopted to address the research question. The chapter begins with the description and explanation of the research methodology, research paradigm, research design and research strategy including justification for the choices adopted and implications thereof. The sampling framework for data collection is discussed including population, sample size, sampling strategy, sourcing of the sample, data collection instrument and implications thereof. Thereafter the data analysis process is discussed including measures to ensure validity and reliability in qualitative research through the concept of trustworthiness. The ethical considerations for the study are also outlined and finally a conclusion to the research methodology chapter.

3.2 Research methodology

According to Antwi and Hamza (2015), the fundamental foundation of research seeks to address what constitutes an effective and 'valid' study and which approach(es) of enquiry is/are suitable for the expansion of knowledge in a proposed study (Antwi & Hamza, 2015). Research involves the methodical undertaking of original work to produce knowledge that establishes or confirms facts, explains problems, develops new theories and delivers novel solutions (Basias & Pollalis, 2018). Research methodology is the macro-level framework that specifies how researchers determine whatever they believe can be known (O'Leary, 2014; Antwi & Hamza, 2015). Research methods are the micro-level methods that scholars utilise for the collection and analysis of data, where the data collection includes interview, surveying and observation and data analysis comprises quantitative or qualitative strategies (O'Leary, 2014).

3.3 Research paradigm

"Research paradigms and their philosophical reflections on applications have been relied upon as fundamental scientific and intellectual support for the accountability of methods and approaches in empirical studies in both the natural and social sciences" (Tekin & Kotaman, 2013, p. 81). Terre Blanche, Durheim and Painter (2014) view the research paradigm as a comprehensive system of practice and thought that explicates the nature of enquiry for researchers along the dimensions of epistemology, ontology and methodology. The interpretivist paradigm, also referred to as the 'anti-positivist' paradigm, arose as the contrasting epistemology of positivism (Mack, 2010). Furthermore, it is recognised as constructivism as it underlines the capacity of the individual to construct meaning (Mack, 2010). Interpretivism focuses on the meaning of social interactions and is based on the view that a strategy requires that social scientists embrace the personal experience of social action (Bryman & Bell, 2011). The current study relied on interviews, observations and analysis of available texts, hence the use of the interpretive paradigm.

3.4 Research design

Research design refers to a rational outline of the strategies that forms the connection between the research question to data collected and the processes applicable to analyse the relevant data to produce meaningful results which address the research questions (Yin, 2011). As stated in chapter one, the questions at the centre of the research design for this study are:

- How do organisations prepare the workforce for multiple job changes across occupational boundaries in the emerging 4th Industrial Revolution?
- What skills sets will the workforce require in order to function effectively in the 4th Industrial Revolution?
- What can government do to mitigate the perceived effect of the 4th Industrial Revolution on job losses?

Research questions are central to research design as they form the hub of the model, the element that directly links to all other components of the study (Maxwell, 2013). Moreover, research questions are the component most directly impacted by the others; they should advise and be sensitive to all the other elements.

According to Terre Blanche et al. (2014) exploratory studies employ a flexible, inductive and open method to exploration as they aim to identify fresh insights into phenomena. Furthermore, the function of exploratory designs is to identify, explore and define the prevailing phenomenon, therefore not only requiring a superficial report of the research occurrences but a comprehensive study of the associated factors required to understand the phenomenon in its entirety (Sharma, 2014). "A cross-sectional design entails the collection of data on more than one case (usually a lot more than one) and at a single point in time in order to collect a body of quantitative or quantifiable data in connection with two or more variables (usually more than two), which are then examined to detect patterns of association" (Bryman & Bell, 2011, p. 53). An inductive approach describes the immersion in the details emerging from data to identify significant groups, dimensions and interrelationships by investigating open questions rather than taking a deductive approach by examining theoretically derived hypotheses. This study employed an exploratory cross-sectional research design using organisations that are knowledgeable on Industry 4.0 from various private and public sector organisations in Gauteng, South Africa.

3.5 Research strategy

A qualitative study aims to provide an in-depth definition, description and interpretation of data (Maxwell, 2013). Qualitative research is defined as the meaning people ascribe to their lives through discovery of their real-life experiences, expression of their observations and perceptions, unambiguous attention to and interpretation of real-life associated situations, contribution of awareness from current or new insights to explain social behaviour and rationale and acknowledgement of the possible meaning of several sources of data in preference to reliance on a single source (Yin, 2016). Maxwell (2013) deems that qualitative research serves to support the investigator to recognise the opinions and interpretations of the participants being observed by concentrating on their experiences and explanations rather than researcher's views on how the

participants' perceptions are moulded by cultural, physical and societal and cultural settings and the processes involved in sustaining or changing these experiences and associations. Characteristics of a qualitative design as portrayed by Leedy and Ormrod (2015) are depicted in Table 3.1.

Table 3.1: Characteristics of a qualitative design

Question	Qualitative
What is the purpose of the research?	• To describe and explain • To explore and interpret • To build theory
What is the nature of the research process?	• Holistic • Unknown variables • Flexible guidelines • Emergent methods • Context-bound • Personal view .
What is the data like, and how is it collected?	• Textual and/ or image-based data • Informative small sample • Loosely structure or non-standardised observations and interviews
How is the data analysed to determine their meaning?	• Search for themes and categories • Acknowledgement that analysis is subjective and potentially biased • Primarily inductive reasoning
How are the findings communicated?	• Words • Narratives, individual quotes • Personal voice, literary style (in some disciplines)

Source: (Leedy & Ormond, p. 99, 2015)

According to Denzin & Lincoln (2011) the assumption made by qualitative researchers is that social reality is an anthropological construct, hence their interpretation and contextualisation of

meanings from the beliefs and habits of people. Flick (2009) has identified the three features of qualitative research as the analysis and acknowledgement of different perspectives, the appropriate research methods and theories and the reflection of the researcher on their study as part of the development of knowledge and the range of research approaches and methods. Qualitative research provides an explanation of what occurs in the study setting (Bryman & Bell, 2011). Qualitative researchers can understand "the political and economic interests that inform organizational actions, in order to enhance the possibilities for changing them" (Bryman & Bell, 2011, p. 403). This study adopted a qualitative research strategy as it afforded the researcher an opportunity to explore the experiences of organisational leaders in Gauteng organisations, with regards to the impact of the 4IR on talent management. Researchers have identified that the 4IR will impact organisations, but there is a paucity of research of the impact in the South African context.

3.6 Sampling framework

Sampling is a critical phase in qualitative research as decisions are usually taken during and resultant from the data collection and analysis process (Flick, 2014). Robinson (2014) discusses a four-point method to the sampling process in qualitative interview-based investigation which presents theoretical and practical concerns: set a sample universe (also known as target or study population); determine sample size; select a sampling strategy; and sample sourcing (that includes the stance on incentives, how to avoid bias, and ethical concerns e.g. getting informed consent from research participants). Sampling is an integral component in addressing rigour as it is partly contingent on an adequate sample - not in relation to size but rather on its ability to provide the essential data for comprehensive analysis (Yardley, 2000). The population, sample size, sampling strategy and sample sourcing will be discussed in the following section.

3.6.1 Population

Population is defined by O' Leary (2014) as the total membership of a distinct class of people, events or objects. Geographical homogeneity is a sample that is chosen from the same location (Robinson, 2014). The accessible population for the present study consisted of professionals at managerial or executive level from six private organisations and four public sector organisations

in Gauteng province, South Africa. A fundamental objective in social science research is to comprehend the demographics or make-up, of a specific population and understand that population's knowledge, practices and attitudes on the chosen topic or issue (O'Leary, 2014). Participants identified for this study were approached to contribute to the study based on their knowledge of the 4IR.

3.6.2 Sample size

Researchers usually calculate the target sample size prior to commencement of the study, but sampling for qualitative studies is less direct (Guetterman, 2015). Marshall, Cardon, Poddar and Fontenot (2013) state that most qualitative researchers openly recognise the lack of standards for determining sample size. The purpose of sampling in qualitative studies is to obtain data that is valuable to grasping the complexity or framework around a phenomenon, as opposed to representing populations as in quantitative studies (Gentles, Charles, Ploeg & McKibbon, 2015). The criterion commonly used for defining the sample size in purposive sampling is theoretical saturation which is a process of data collection that accompanies data review and analysis such that data collection ends when new data collected does not contribute further to addressing the research question (Oppong, 2013).

Mason (2010) examined the sample sizes of qualitative PhD dissertations and concluded that the most common sample sizes were 10, 20, 30 and 40, from a mean sample size of 31. Cresswell (2012) proposed a sample size of between 5 to 25 for phenomenology studies. Guest, Bunce and Johnson (2006) used the coding procedures of Glaser and Strauss (1967) to determine the number of interviews vital to achieve saturation. Following 60 interviews, Guest et al. (2006) found that by the 12th interview, 100 percent of the 109 thematic codes had been found. The result of thematic code prevalence was confirmed by calculating the Cronbach's alpha measuring the reliability of the code frequency distribution as analysis progressed (Guetterman, 2015). A Cronbach's alpha of 0.70 was achieved within 12 interviews and hence regarded as the saturation threshold by Guest et al. (2006). However, Constantinou, Georgiou and Perdikogianni (2017) have concerns of the methodology used by Guest et al. (2006) to conclude that the 12th interview was the saturation threshold:

- What is the ideal number of the initial sample?
- What would happen to the saturation threshold if the order of the interviews was rearranged prior to checking?
- A small number of interviews could result in the number of themes being concentrated in the first few interviews in the sequence, possibly affecting the saturation threshold.

Constantinou et al. (2017) led 12 semi-structured interviews to examine their research question and found the 8th interview to be the dominant saturation threshold. However, in the analysis of their study, the authors included all 12 semi-structured interviews.

Saturation remains the barometer for the measurement of the diversity of samples in research (Guest el al., 2006). However, O' Reilly and Parker (2012) caution that saturation has multiple subjective meanings and consequently, limited transparency. There is no 'copy and paste' approach to reach data saturation; however, more may not inevitably be better than less and vice versa (Fusch & Ness, 2015). Oppong (2013) suggests that sample size may also be due to accessibility of resources, time constraints and objectives of the research and may thus be determined prior to collection of data. "An initial approximation of sample size is necessary for planning, while the adequacy of the final sample size must be evaluated continuously during the research process" (Malterud & Guassora, 2015, p.7). For planning purposes, the minimum sample size proposed prior to commencement of this study was ten research participants from selected private and public sector organisations in Gauteng, South Africa.

3.6.3 Sampling strategy

Non-probability sampling refers to a form of sampling involving the selection criteria is not decided by a random statistical principle (Terre Blanche et al., 2014). "The purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses. It is a non-random technique that does not need underlying theories or a set number of participants" (Etikan, Musa & Sunu, 2016, p. 2). Judgmental sampling involves the researcher using their own judgment to select participants based on their contribution to the problem due to their expertise (Rahi, 2017). Purposive sampling is used when one can learn

from cases rich in information whereby issues are of critical to the research objective(s) (Patton, 2015). New jobs and roles are on the rise while others risk disappearing and as recruitment becomes more nuanced, more organisational leaders must understand and evaluate the core competencies of their workforce as they evolve in the 4IR (Mdluli & Makhupe, 2017). Tarry (2018) recommends that the influence of Artificial Intelligence be considered from three core perspectives: within HR; in the business HR serves and in wider society and the global context. Organisational members were thus selected from within HR, the business partners to HR and governmental organisations which represents the wider society as policy affects business and society at large. Purposive sampling was utilised to identify organisational leaders in private and public sector organisations in Gauteng to participate in the study. An organisational leader in the context of this study was defined as a participant at managerial or executive level. The decision to involve participants from various industries was because disruption will impact all industries and companies (Schwab, 2016). However, the industries for this study were finance, ICT, education and mining.

Purposive sampling was utilised for this study to identify an initial group of individuals to interview. The researcher also made use of snowball sampling in addition to purposive sampling. Creswell (2012) describes snowball sampling as a sampling technique that identifies potential participants from people who know others who can provide rich data for the intended purpose. The researcher thus established contact with other recommended individuals that could provide valuable knowledge on the topic of investigation.

3.6.4 Source the sample

Once the sample universe, sample size, sample strategy has been addressed, the researcher needs to identify participants from the real world (Robinson, 2014). Some of the ethical considerations to consider prior to approaching potential participants is how the method of recruitment may impact research responses e.g. offering a financial incentive for participating in the study. Yancey, Ortega and Kumanyika (2006) posit that the advantage of incentives is that, it is a motivator as they increase the probability of participation and the possibility of retention in longitudinal studies. Robinson (2014) cautions against use of incentives and is of the opinion that participants may fabricate their responses for financial gain. The researcher did not offer financial incentives to

those partaking in the study. The extent to which the sample universe, sample size, sample strategy and sourcing the sample are addressed and defined in a qualitative study has consequences for its coherence, impact, transparency and trustworthiness (Robinson, 2014). The issues of trustworthiness and ethical consideration are discussed in detail in sections 3.9 and 3.10 respectively.

3.7 Data collection

Research participants were selected from various organisations in Gauteng province in order to make participation characteristic of the population. The researcher used their professional network to identify potential contributors to the study based on the industries and sector. The contact person of the identified organisations assisted the researcher in identifying professionals best suited for the study according to the criteria in the sampling strategy. An email highlighting the purpose of the study was sent to prospective research participants requesting their voluntary participation. A suitable date and time were arranged for interviews to be conducted on participants that agreed to partake in the study. Interviews were conducted from April to June 2019, with the estimated duration for each interview being forty-five minutes to an hour. The data required to respond to the research question of the study were collected by conducting semi-structured face to face interviews. Interview responses were captured by means of a voice recorder and later transcribed by the researcher.

3.7.1 Data collection instrument

Rowley (2012) posits that semi-structured interviews have a variety of forms, with an array of questions, and adaption of questions which are ordered to benefit the participant interviewed. According to Edwards and Holland (2013), most qualitative studies use semi-structured and unstructured interviews, with the core features being interactional dialogue exchange, a topic-centred approach and the researcher (interviewer) supplying the necessary context, meaning and understanding during the interview in order to elicit the required responses. Focussed or semi-structured interviews offers the researcher more control through greater flexibility and better understanding of the perspective of the interviewee (Dane, 2010). An interview guide was used to ensure that questions relevant to the study were addressed (see Annexure A). The interview guide

was carefully developed using the guideline provided by Bryman and Bell (2011, p. 468). The semi-structured interviews were thus focussed prior to commencement using the three steps provided by Bryman and Bell (2011) as follows:

- The author first introduced the interview by asking participants to give their general perspective on the impact of the 4IR in South Africa using the research topic.
- The research participants selected were managers and executives with strategic responsibilities and knowledge of the research topic.
- Research participants were interviewed at their workplaces to keep them in the physical context of their strategic role.

Furthermore, the researcher used questions from Hattingh (2016) and other literature to develop the interview guide. The researcher however had leeway to ask questions that were not included in the interview guide to explore answers given by the respondent.

3.8 Data analysis

Qualitative methods such as critical ethnography, framework analysis, grounded theory, interpretive phenomenological analysis and template analysis are associated with thematic data analysis (Madill & Gough, 2008). Thematic analysis is a technique used to recognise patterns and themes of meaning across a data set relative to the research question (Braun & Clarke, 2013). Nowell, Morris, White and Moules (2017) maintain that in qualitative research, thematic analysis is a method that can be extensively over a series of epistemologies and research questions. Braun and Clark (2013) suggest that thematic analysis is probably the commonly used process of data analysis, there is however a shortage of literature on how to conduct an appropriate and rigorous thematic analysis (Nowell et al., 2017). A further shortcoming of thematic analysis is that in comparison to other approaches, it limits the researcher to make assertions about language use (Braun & Clark, 2006). Although a flexible form of data analysis, the flexibility of thematic analysis can be inconsistent and incoherent when themes are developed from the data collected (Holloway & Todres, 2003). The onus is thus on the researcher to assure that rigour and

trustworthiness is applied when conducting data analysis (Nowell et al., 2017). This study utilised a thematic analysis for data analysis.

Harding (2013) proposes a four-step approach in analysing themes:

- Identify the theme and categorise.
- Collate codes from various illustrative subjects into the appropriate category.
- Create sub-categories to reflect contrasting elements of the themes.
- Use the themes to describe relationships between various parts of the data and build theory.

Vaismoradi, Jones, Turunen and Snelgrove (2016) also suggest four phases to theme development in content and thematic analysis namely: initialisation, construction, rectification and finalisation. Each phase consists of further stages that are described in Table 3.2.

Table 3.2: Phases and stages to theme development in content & thematic analysis

Phases	Stages
Initialisation	• Read transcriptions and highlight meaningful units; • Code and look for abstractions in participants' accounts; • Write reflective notes.
Construction	• Classify; • Compare; • Label; • Translate & transliterate; • Define & describe.
Rectification	• Immerse and distance; • Relate themes to establish knowledge; • Stabilise.
Finalisation	• Develop the story line.

Source: (Vaismoradi, Jones, Turunen & Snelgrove, 2016)

The method for qualitative data analysis remains unchanged regardless of whether coding by hand or a computer, namely: the researcher first classifies a text or image segment, secondly they allocate a code label and finally searches the entire database for all text segments assigned the same code label (Cresswell, 2012). Electronic files are convenient for storage of transcribed interviews, observation data and memos (Ngulube, 2015). Unfortunately, no software can analyse qualitative data; only the human mind has the capability to code and categorise the data (Cresswell, 2012; Faherty, 2010). The computer program merely provides a means to store data and accessibility to the codes assigned by the researcher (Cresswell, 2012). Several researchers have shown how stand office programs such as Microsoft Word (La Pelle, 2004; Ryan, 2004) and Microsoft Excel (Amozurrutia & Servos, 2011; Meyer & Avery, 2009) can be utilised for qualitative analysis through the coding and retrieval of interview data, conditional formatting and other functions. Microsoft Office provides access to basic functions to structure interview data and systematic coding which is useful to many researchers as it is used by millions around the world (Ose, 2016). The researcher used Microsoft Word and Excel to code qualitative data by sorting text into themes and sub-themes.

The basic 10-step process used to analyse the data was adopted from Ose (2016) as follows:

1. Data collected.
2. Transcribed audio files.
3. Transferred text from Microsoft Word to Microsoft Excel.
4. Prepared the Microsoft Excel spreadsheet for coding.
5. Coded in Microsoft Excel.
6. Prepared the coded interviews for sorting.
7. Sorted the data.
8. Transferred quotes and references from Microsoft Excel to Microsoft Word.
9. Sorted the text into a logical structure based on the coding.
10. Analysed the data.

According to Williamson, Given and Scifleet (2013) there is no standard system of recording qualitative data, however the method used for data collection and management of resources

provides procedural precision and protects the research quality (Birks & Mills, 2011). Maintaining an audit trail of the data may enhance the authenticity, credibility, dependability and plausibility of the research project (Ngulube, 2015). The researcher followed the guideline provided by Ose (2016) for transcription of data by keeping each interview in a separate Microsoft Word file and a numbered list of all interviews. All data collected for the study were saved onto the researcher's password locked laptop and saved to a secure locally encrypted hard drive.

3.9 Trustworthiness

A qualitative study must establish trustworthiness in procedural precision in all stages of the study from data collection to finalisation of the report. The degree to which a study is deemed to be applicable depends on the general assessment principles of rigour or trustworthiness, where rigour is the capacity to reason in a stringent rational manner (Ibiamke & Ajekwe, 2017). Credibility, confirmability, dependability and transferability are considered as the vital components in establishing trustworthiness in qualitative inquiry (Lincoln & Guba, 1985). Lincoln and Guba's framework are widely applied to establish trustworthiness and was thus the chosen method to confirm trustworthiness in this study.

3.9.1 Credibility

An organised mechanism for management of research data confirms the credibility of the research result (Birks, 2014). Smith (2015) highlights the imperativeness of qualitative researchers to include strategies to improve the credibility of the research during research design and implementation. Some recommended strategies to increase credibility are:

- Demonstration of a clear decision trail, meticulous record-keeping and transparency and consistency in data interpretations (Long & Johnson, 2000; Sandelowski, 1993);
- Inclusion of rich verbatim descriptions of accounts as provided by participants to support results (Slevin, 2002);
- Demonstration of clarity in thought developments undertaken in data analysis and consequent interpretations (Sandelowski, 1993);

- Peer debriefing which entails discussion of the research process and findings with experienced professionals within the academic community who may identify negative case analysis and other categories not covered by the research question (Anney, 2014).

The researcher sought guidance from their supervisor to improve the interpretive process and quality of the study. Audio recordings of the interviews ensured transparency and consistency in data interpretations as it delivered clarity in data analysis. The researcher revisited the audio recordings numerous times to ensure that the data captured and the themes that emerged were reflective of the participants' accounts. Verbatim quotes are also included in the data analysis to ensure that the participants' reflections on the research questions are accurately reflected.

3.9.2 Dependability

Dependability is akin to reliability in quantitative research (Constantinou et al., 2017). To meet the conditions of dependability, qualitative researchers must define their research design, data, coding and analysis process so that their study can be replicated by other scholars (Constantinou et al., 2017). Studies suggest that dependability can be enhanced through an audit trail (Bowen, 2009; Bryman & Bell, 2011; Lincoln & Guba, 1985). The auditing approach involves accurate recordkeeping to justify all stages of the research course - problem formulation, choice of research participants, minutes, interview transcripts, data analysis, and so forth - with accessibility being key (Bryman & Bell, 2011). The code-recode strategy involves coding the same data twice with a gestation period of a week or two between each coding (Anney, 2014). The code-recode strategy aids the researcher gain a thorough understanding of data outlines and improves the depiction of participants' account (Ary, Jacobs, Razavieh & Sorensen, 2010). The gestation period for this study was one week. Dependability for this study was addressed through an audit trail and the code-recode strategy. The decisions governing the theoretical, methodological and analytical choices are included in the research report.

3.9.3 Confirmability

Confirmability in qualitative research is the equivalent of objectivity and seeks to ensure that researchers echo the experiences and opinions of participants and not the researcher's own ideas and values (Constantinou et al., 2017). Confirmability establishes that the data and interpretations of the research findings are not fabrications of the researcher's imagination (Tobin & Begley, 2004). Bryman and Bell (2011) recognise that whilst overall objectivity is inconceivable in business research, the inquirer must act in good faith by not allowing their own values or theoretical predispositions to impact the outcome of the study. An audit trail allows for individuals outside the research (external auditors) to study and review the documents making the narrative interpretation trustworthy (Constantinou et al., 2017). Birks (2014) recommends capturing the research activities including deviations from the original research plans including motives and exceptions thereof, to establish professionalism and to gain the trust of readers in your results. The illustration of the development of each analysis should provide the reader with adequate material to navigate every step to the findings (Crowe, Inder & Porter, 2015). Auditability was established through storage of detailed and complete records from inception to finalisation of the research report in the current study.

3.9.4 Transferability

A key characteristic of a qualitative study is that research questions are usually limited through the study of a central phenomenon in a chosen context (Guetterman, 2015). The intention of the qualitative scholar is not to generalise from the sample to the population, but rather to describe, enlighten and interpret the phenomenon (Maxwell, 2013). Sampling is therefore not about forming representative opinions, but rather about the substance of data richness (Guetterman, 2015). Lodhia (2019) views the generalisability of the study as being of utmost importance and this includes qualitative research. Statistical generalisability is not practical in qualitative research, but qualities of 'thick description' that display findings with selected categories that are clear and supported by adequate data are anticipated (Anderson, 2017). In qualitative research, this can be achieved through naturalistic and theoretical generalisation rather than statistical generalisation (Parker & Northcott, 2016).

Transferability comprises offering the reader with enough evidence for assessing similarities or differences between the context for the research and their own practical setting, as context strongly influences findings (Crowe et al., 2015). The researcher enables the transferability judgement by a probable reader through purposeful sampling and thick description (Bitsch (2005). The researcher needs to provide a comprehensive explanation of the study and purposively select participants to facilitate transferability of the research (Anney, 2014). On reflection of the notion of qualitative research being a detailed understanding of social phenomenon, Constantinou et al. (2017) argue that saturation demonstrates that adequate depth has been reached and thus provides a means for the researcher to make sense and describe. A description of the sampling framework and the method used to determine saturation is detailed in this study (see section 3.6).

3.10 Ethical consideration

Ethics is central to research integrity and is referred to as the rules of behaviour or principles that prescribe what is permitted within a designated profession (O' Leary, 2014). According to Denzil and Lincoln (2013) qualitative research involves the researcher being situated within the participants' world and data collection approaches are used to record the participants' perspective. Although existing literature is not explicit (Brummans, 2014), qualitative research could benefit from integrating mindfulness interventions as an instrument for data collection and analysis by being present in the moment (Lemon, 2017). Mindfulness as defined by Kabat-Zinn (2003) as the awareness that arises through "paying attention on purpose, in the present moment, and practicing non-judgement of the experience throughout each moment" (p. 145). The researcher remained mindful by endeavouring to remain objective, conducting research with integrity and respecting participants throughout the research process. Leedy and Ormrod (2015) consider honesty with professional colleagues, voluntary and informed consent, protection from harm and the right to privacy as the four elements of ethical research.

3.10.1 Honesty with professional colleagues

The function of ethics committees is to supervise ethical issues conducted in research in their organisations by formulating the research ethics code of conduct and overseeing its application in research led by its members (Walliman, 2011). This study was conducted within the scope of the

ethical requirements of the Research Ethics Committee of the institution. Data collection only commenced once the ethics clearance certificate was issued by the Research Ethics Committee. An email was sent to prospective organisations with the ethical clearance certificate and a participation letter attached which detailed the research objectives and what participation entailed. Approval was obtained from the relevant departments and organisations that participated in the study. The researcher further complied with departmental or organisational requirements for conducting research by providing further documents as requested. The organisations provided the researcher with prospective participants best suited to address the research objectives.

3.10.2 Voluntary and informed consent

Informed consent is the participants' right to be protected against vulnerability (Seidman (2013). In research, this entails ensuring that no harm comes to respondents, respondents have given informed consent and ensuring confidentiality and anonymity (O' Leary, 2014). Although the researcher relied on organisational leaders to identify suitable participants, an email was sent to the recommended participants inviting them to participate in the study. Participants were informed of the purpose and aims of the study, what their involvement entailed and that their participation was voluntary. Besides informed consent prior to the study, the researcher also obtained verbal consent from participants prior to recording an interview.

3.10.3 Privacy and protection from harm

The researcher has a fundamental responsibility to protect the well-being and dignity of respondents both mentally and physically (O' Leary, 2014). The interviewer must create an environment in which the participant feels comfortable to respond comprehensively and honestly (Moustakas, 1994). Lindlof and Taylor (2011) assert that mindfulness provides the researcher a chance to examine self-reflexivity as reflexivity is at the core of qualitative research. To create a comfortable climate for the participants and establish rapport, the researcher gave participants an opportunity to select a venue for the interviews. Participants who could not meet for face to face interviews at their workplace or an alternative venue were accommodated via telephone calls.

Protection of participants from harm is addressed in ethical codes that advocate for care in handling confidentiality and anonymity of accounts (Bryman & Bell, 2011). Furthermore, it involves identifying risks and choosing approaches that minimise these risks and avoiding any disclosures that could be harmful to the dignity, reputation or privacy of the participant (Walliman, 2011). To ensure confidentiality, anonymity and privacy, the researcher addressed the possible identification of participants by not indicating or referring to private data (Bryman & Bell, 2011; Klenke, 2013). Private data was replaced with the word Participant and respondent number to prevent identification of the research participants. Furthermore, no information was used to identify the name of the organisation.

3.11 Summary of chapter

This chapter outlined the qualitative methodology that was adopted to explore the impact of the 4IR on talent management and to answer the research questions. The justification for the research methodology, research paradigm, research design and research strategy were discussed. The sampling framework for data collection including population, sample size, sampling strategy, sourcing of the sample was also discussed. Data collection and the data collection instrument was also discussed. The research sample for this study comprised eleven participants purposively chosen as the population was specialised and focussed on participants with knowledge on the 4IR. Snowball sampling was also used to identify further participants through leads provided by participants of the study. The validity and reliability of the data analysis in the study were addressed through the components of trustworthiness which are credibility, dependability, confirmability and transferability. The ethical considerations for the study were also outlined through the categories of honesty with professional colleagues, voluntary and informed consent, privacy and protection from harm. Chapter 4 will present the empirical findings for this research through the themes identified through data analysis.

CHAPTER 4

DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 Introduction

The previous chapter described the research methodology that was adopted to conduct the study. This chapter presents a detailed overview of the empirical findings through the themes that emerged from the analysis of participants' observations. This chapter will expand on the profile of the research participants as introduced in chapter 3. Thereafter the findings are presented according to the three research objectives. The description of the themes and sub-themes derived from the analysis are discussed under each research objective. A summary of the research results will conclude this chapter.

4.2 Profile of participants

Section 3.6.3 of the preceding chapter laid the foundation for the sampling strategy of the study. Table 4.1 provides a synopsis of the profile of the participants of the study.

Table 4.1: Profile of participants

Pseudonym	Job level	Sector/ Business unit	Core perspective
Participant 1	Executive	ICT	Business partner
Participant 2	Manager	Education	Human resources
Participant 3	Executive	Business	Society
Participant 4	Manager	Education	Human resources
Participant 5	Executive	Business	Society
Participant 6	Manager	Business	Society
Participant 7	Manager	ICT	Business partner
Participant 8	Executive	ICT	Business partner
Participant 9	Manager	Education	Human resources
Participant 10	Manager	ICT	Business partner
Participant 11	Executive	ICT	Business partner

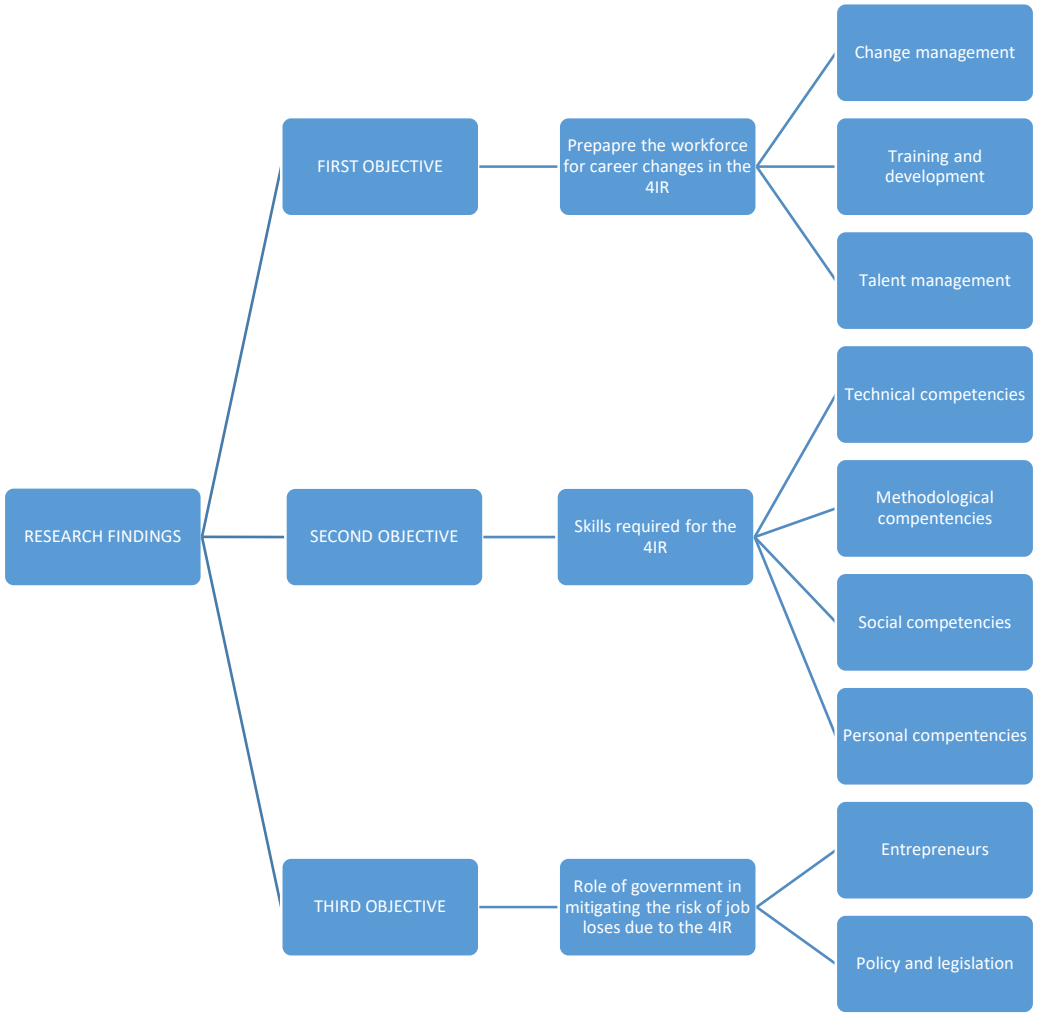
To ensure anonymity, respondents are referred to using the pseudonym ‘Participant 1, 2, 3 … 11’ as illustrated in Table 4.1. Given that some participants were referred through snowball sampling, in addition to the pseudonym, the researcher also used gender-neutral pronouns such as ‘they’ to further guarantee anonymity of participants.

4.3 Data results

The interview transcriptions were examined using the four phases to content and thematic analysis outlined by Vaismoradi et al., (2016) which consists of initialisation, construction, rectification and finalisation. Each phase comprises further stages that were described in the preceding chapter in Table 3.2.

The researcher interviewed eleven individuals who met the criteria outlined in Table 4.1. The open-ended questions posed during the interviews were limited to the participants’ knowledge of the research topic and were aligned with the research objectives. The themes that emerged are summarised and discussed under the relevant study objective/research questions. Figure 4.1 provides a diagrammatic representation of the research findings.

Figure 4.1: Diagrammatic representation of research findings



Source: Author's own construction

4.4 Data analysis related to the first objective/research question

The first objective of the study explored the organisational leader's interpretations and experiences of how organisations should prepare the workforce for career changes across occupational boundaries in the 4IR. The three themes that emerged from this objective are as follows: change management, training and development and talent management. These three themes were further divided into sub-themes as shown in Table 4.2.

Table 4.2: Data analysis related to the first objective/research question

First objective	Theme	Sub-theme
Factors that prepare the workforce for career changes across boundaries	1. Change management	• Communication • Stakeholder collaboration • Education
	2. Training & development	• Continuous professional development • Stakeholder/ organisation initiative • Learning organisation • Higher educational system
	3. Talent management	• Organisational culture • Recruitment and selection • Job redesign/rotation • Flexi-time work arrangement

Participants were asked to propose how organisations should prepare the workforce for multiple career changes across professional boundaries. In response to this question, participants considered observations from their own work environment and through interactions with other stakeholders. Furthermore, participants' responses to the general perception of the impact of the 4IR in South Africa were also included. Another probing question that addressed the current objective was a question derived from the definition of talent from Ulrich and Smallwood (2012). The purpose was to explore how organisations are preparing organisational members and its stakeholders to embrace 'disruption' to the work environment.

4.4.1 Theme one: Change management

The theme change management includes the sub-themes communication, stakeholder collaboration and education. The sub-theme communication broadly discusses the communication

strategy that organisations should adopt to prepare the workforce to embrace the changes that will disrupt careers across industries. The sub-theme stakeholder collaboration focuses on the role of organisations in preparing the workforce for the career changes associated with Industry 4.0 through strategic and social partnerships. The focus of the sub-theme education is on sharing knowledge of Industry 4.0 with the workforce.

Participant 1 stated the opportunities for humans:

> People think that the 4IR is coming to take peoples' jobs and I feel it's more around augmentation between humans and machines … So, let's prepare people to know how to operate these machines and maintenance of these machines. So new machines need to be manufactured, so the opportunity revolves around the new opportunity streams that are going to be opened by the 4IR. It's not just going to take away peoples' jobs.

Participant 2 provided examples in the fast-moving consumer goods (FMCG), services and financial sectors of how their customer experience has been enhanced through automation. Furthermore, they discussed the opportunities for the youth "the exciting thing about the whole 4IR is that it is coming at a time where a huge part of the society is young people, millennials, so the learning will change." Participant 3 also provided a macro-economic overview and used the benefits of the internet of things (IOT) and how data will influence decision making through efficient management of resources such as financial resources, human capital resources and social capital to demonstrate the impact. The misconception that technology will replace jobs was also underlined by Participant 3 "I think that increasingly technology will augment what people are capable of doing, it will not replace them." Participant 4 emphasised the importance of communicating the impact of the 4IR to the employees "Yes people might despair, people might be slow to grab the importance of change, but as you keep communicating people will slowly realise that it is for their benefit." Furthermore:

> Someone is talking about the 5IR and we're still lagging on the 4IR. However, it will be great for business in SA, we need the change. However, there is a need to train employees

> to reskill to deal with the fear of 'I'm losing my job'. They need to know that there has been the 1st, 2nd and 3rd revolution and people still had jobs (Participant 4).

Participant 5 also focussed on the fear aspect. "There's uncertainty in terms of people being worried that they don't know what's going to happen with their jobs, but there's a lot of opportunities." According to research conducted by Participant 5's organisation "if people are empowered, they are able to engage not only with the machines, but they are able to engage in conversations which seek to promote the economy." Participant 5 also mentioned further benefits. "I mean the 4IR is affecting organisations positively in terms of how we do things, how we think, how we plan – for me it's a positive thing." Participant 6 was also optimistic "I think the 4IR has the potential to make things more efficient and effective. There's the positive impact of the 4IR. It's the use of technology to improve things for people." Furthermore, Participant 6 emphasised that the 4IR will not result in job losses and provided examples of the new opportunities within various industries that have emerged:

> The 4IR encompasses many things, it includes big data, biotechnology and artificial intelligence…. Our [organisation] is predominantly industrial related, so we've got mining, the 4IR is going to impact mining in terms of robotics. I'm not sure how it would work in terms of AI but maybe in terms of prospecting in terms of using computing power more than geologists…Also, you've got metals being replaced by plastics or being replaced by 3D printing. Look at agriculture, there are [many ways] to farm using hydro technology, computers, drones, so there's potential to disrupt along all the value chains associated with our organisation.

Participant 6 also mentioned that although people may know of artificial intelligence, their workforce does not fully contextualise the impact it will have on their day-to-day jobs and their clients, hence their organisation drafting a 4IR strategy.

Participant 7 also explained how automation has improved the customer experience and improved quality processes in their work environment. Furthermore, Participant 7 explained how opportunities have been created "more people in financial services roles will become redundant

and more and more roles will be created that weren't there before e.g. robot (bot) managers, chatbot trainers". Participant 8 focussed on the benefits of technology. "In companies, when people talk about using technology, they always talk about how it is taking jobs away. There is some truth to it, but it also simplifies and gets productivity to be optimal at the same time." Participant 8 also mentioned the role that media have in the dissemination of information. Participant 9 provided a few examples of how their organisation could benefit from automation "I believe it will have a positive impact because currently in … our systems are paper based and it's a nightmare to provide good quality services to our communities …The 4IR will help us fast track the work that we're doing."

Participant 10 also mentioned how 'disruption' has improved our lives:

> It's an exponential change in how we work, the way we live, the way we shop and the way we socialise. South Africa is part of the globe [and Industry 4.0] brings in advancement [because] there are new fields in our business landscape. So, artificial intelligence like big data, nanotechnology and bioengineering is rife, it's here. We can close our eyes and pretend that it's not here, but I think it's an opportunity…"

Participant 11 also described how AI has simplified our lives socially but also the changes to the business environment. "You can actually reduce your labour force and serve your customers just through a self-service experience, you don't have to use manual labour. So, I think it's got its pros and cons but largely there are lots of opportunities."

Deriving from the participants' responses on the opportunities of the 4IR, the researcher feels that a clear communication strategy may alleviate some of the fear mongering. Participant 1 highlighted the importance of organisational leaders in driving change "so there needs to be a lot of user education, especially from management coming down …These people need to converge and be in the same room and be able to have honest conversations about how technology is going to affect them."

Participant 2 suggested that unions need to be embraced as strategic partners and suggested that they be included in dialogues to facilitate open communication "There are too many secrets at Exco level that they don't want the union to know and yet to create a sustainable and globally competitive future, it might be wise to offer unions a seat at the table." Participant 3 also agreed on open communication between stakeholders. "One of the biggest issues is a lack of trust between every different stakeholder and I think that the lack of trust … leads to a disbelief of the intentions and agenda of every other group. So, your ability to develop a common vision for any group is disrupted." Participant 3 suggested trust building exercises for better collaboration between stakeholders. However, Participant 4 suggests that organised labour is aware of the 4IR through roundtable discussions that their organisation has hosted, so they should train their workforce by imparting knowledge through their supervisors. Moreover, Participant 4 also suggests "So, we need to ask what's going to happen in the future? That's where academics and researchers will be valuable in terms of predicting what will happen in the future and make people be ready for that." Another recommendation for collaboration by Participant 4 was for unions to help government fulfil its mandate "Government should work hand in hand with trade unions as that's where the major influence comes from. The sooner they do that, the better. They should be proactive and through the trade unions they can reach their goal."

Participant 5's organisation has engaged in social dialogue with their social partners. Participant 5 suggests that business need to discuss the impact of automation on job losses and the role of business in promoting the requisite skills in communities by engaging the youth. The role of change management and dealing with AI in the right context was also discussed by Participant 5:

> A paradigm shift can come through exposure to knowledge, then we can deal with that issue I raised in terms of changing behaviour and acquiring new skills. In terms of the 4IR, what does mechanisation mean? What does knowledge technology mean? Because it's not just about being able to use the computer. It's about understanding the systems that comes about through this new era.

Participant 8 provided macro-environmental factors such as global warming, hurricanes, oil prices and terrorism to illustrate risk aspects that can impact decision making within organisations.

Participant 8 suggested the use of artificial intelligence as a strategic tool to anticipate change. “AI is now supposed to be used by CEOs for strategy to say this is where we are going.” Participant 9 provided an example of how some unions in their sector treat the biometric logging with scepticism by suggesting that it is a system to police workers. Participant 9 suggested “Change management will also play a critical role because we can’t come up with a new system and expect people to embrace the change without understanding why they need to move to this particular change.”

The issue of communication was a prominent theme with participants lamenting the negative message conveyed across various media about the 4IR. All the participants felt that the current message portrayed is on job losses, which exacerbates fear and uncertainty for the workforce. The consensus was that although there will be job losses, there are new job opportunities emanating from this revolution. Furthermore, technology such as AI, big data and robotics have boosted productivity and efficiency for organisations, the workforce and customers. The responses from participants indicated that the change management process is a collaborative process which requires all stakeholders to work together to prepare the workforce to drive a common transformation strategy.

4.4.2 Theme two: Training and development

The theme of training and development emerged as a solution to prepare the workforce for careers of the future. The sub-themes included for discussion are the role of stakeholders and continuous professional development, stakeholder/ organisation initiative, learning organisation and the higher education system. The sub-themes are intertwined and will thus be broadly discussed.

Participant 1 cited the role of organisations in addressing the training and development aspect. “Of course, organisations need to create opportunities for these people to upskill themselves. Companies need to create learning programs whereby people are going to be upskilled with new technologies.” Similarly, Participant 2 mentioned how an environment for continuous learning can be provided. “What we need to do is to create jobs that open up people to continuous learning in such a way that they can acquire the requisite skills to function in various jobs.” Participant 6 also focussed on the role of organisations. “Organisations will need to broaden their training offerings to allow people to continuously learn and reinvent themselves as things change in the [learning

organisation].” Participant 6 also suggested that organised labour have a greater role in accelerating change within organisations. “Bring the unions on board in terms of the agreement so that they can train and upskill their members instead of just protecting the status quo.”

Participant 3 provided an example of how other stakeholders need to evolve. “I think if universities still want to remain relevant, they have to fundamentally rethink the way that they provide education as it is irrelevant for workers of tomorrow.” Participant 3 recommended that “Shifting our education system from batch processing to continuous processing is an idea that can be explored.” Furthermore, Participant 3 advocates for unions to help its members develop the capacity to remain relevant through a “strong internal skills development function”. Participant 3 highlighted that the unions could get organisations to pay the unions to provide training as companies do not share the interest of workers as unions. Participant 3 also emphasised the importance of basic skills in preparing the workforce for career changes associated with the changing world environment:

> I think there are [a few] foundational skills that can be applied across any country … Then there are more specific skills for example basic numeracy, basic literacy, comprehension, these are fundamental skill sets that are useful in a range of different things. So, I think that countries that have a strong base foundation of education will ultimately be more able to adapt to whatever comes.

Like Participant 3, Participant 4 interrogated the relevance of what is offered at universities “What can be done to prepare students for future? Is what we offer of any use to our future professionals? How can we reshape the curriculum to prepare them for the future?” Participant 4 suggested that HR is the heart of the organisation and should therefore be invited to strategic sessions “HR is there to advise executives in terms of which way to go. HR should be given that opportunity as they are responsible for learning and development.” Participant 4 suggested that organised labour and organisations need to offer work integrated learning to allow the workforce to develop their capabilities for the new world of work. Participant 10 also advocated for work integrated learning “I think we need to be a little more creative in how we do our learning and bring in more experiential learning.” The participant further reiterated on the role of HR in training and

development “I think that if HR do not pull up their socks and earn a seat at the table then business will find their own way of institutionalising certain programs on their own.”

Research conducted by the organisation of Participant 5 proposes retraining and upskilling to address career changes due to the 4IR. Moreover, the workforce needs to be involved in the construction of knowledge through training and workshops. Similarly, Participant 5 raised the role of education institutions in preparing the workforce for career changes by proposing that the content offered at primary education needs to be interlinked with what is offered in higher institutions.

Participant 7 advised that it is not the sole responsibility of universities and technikons to reskill the workforce and suggested that on-job-training can be provided through government initiatives “Learning and development plays a role with the (Sector Education and Training Authorities (SETAS), the Black Economic Empowerment (BEE) charter requirement and also delivering the right skills for the 4IR.” Likewise, Participant 8 suggested that both government and business are responsible for ensuring workforce readiness “They’re supposed to be the policy and training institute of how to ensure students are fit for this economy.” Participant 9 mentioned that their organisation already has training in place “Most of our programs are planned for educators changing them towards using technology, so those programs are there. But in the office, we’re quite slow.” Participant 11 suggested that organisations need to help people transition through their learning and development programs “That means they need to restructure our training model to get our team ready to operate in the transformed environment.”

All participants acknowledged the role of training and development in preparing the workforce to embrace the anticipated career changes across occupational boundaries. This theme also addressed the role of various stakeholders in the creation of knowledge through the learning organisation by promoting continuous professional development. Furthermore, recommendations were made on the responsibility of stakeholders in upskilling the future workforce through the higher education system

4.4.3 Theme three: Talent management

The theme of talent management includes the sub-themes organisational culture, recruitment and selection, job redesign/ rotation and flexi-time work arrangement. The theme 'talent management' explores the role of HR in preparing the workforce for career changes associated with the new world of work. The sub-theme organisational culture broadly discusses mechanisms that HR practitioners can use to prepare the workforce. As a probing question, participants classified as business partners to HR were requested to make recommendations on how HR can address the first objective.

Most of the participants highlighted greater flexibility in organisational structure and talent management as being critical in preparing the workforce for career changes associated with the 4IR. Participant 1 suggested the following:

> Unfortunately, the systems that were created are so rigid. When you work for an organisation, they only pin you down to one role, they don't allow you to do your own thing on the side. People should be given adhoc contracts…. When we work in silos you're limiting [your potential].

Likewise, Participant 2 supported job rotation:

> [The work design is] focussed on deliverables, focussed on objectives and the purpose, so it boxes employees. What we need to do is to prepare the workforce to start embracing the flat structure, instead of hierarchy … So, you want to equip people with the requisite soft skills that they need to function across various departments … we want to create a future workforce where employees have the flexibility to move around and grow sideways and upward (Participant 2).

Additionally, Participant 2 promoted the repurposing of roles and suggested "you will need a job profile and not a job description" to equip employees with other skills. The repurposing of roles

was shared by Participants 4, 7 and 11. The notion of introducing more flexible work structures and work designs was supported by other participants:

> So, your workforce plan … needs to come from talent management. Move people around in an organisation in order to identify where an individual best fits in (Participant 4).

> The way work is structured outside of the 4IR is too boxed. So, it's our duty to break this box and bring some versatility … I've discussed [flexible work] – different genders in the world of work with different needs at different stages in their life so if we use that to bridge the gap so that no one suffers in terms of income and career progression … if you infuse 4IR, AI requirements into our policies, it will take care of that, so that we can all operate from an equal footing (Participant 5).

> [What is required are] policies that are a little more flexible around role descriptions … instead of being pedantic about this is the only thing on my job description which is also part of a closed mindset (Participant 6).

Participant 9 also suggested a change in policies to embrace flexible work structures and lamented the resource inefficiency in driving to meetings and mentioned other systems "Now if we had the technology, we would be able to cut out all the unnecessary things like time spent on the road and like waiting for a file to be brought to you." Besides resistance to change from stakeholders, Participant 9 mentioned budgetary constraints as a factor to the slow pace of transformation.

When discussing recruitment strategies, Participant 2 stated:

> We want to get to a point in recruitment where psychometrics will complete some activity or game on their laptop or machine, by virtue of doing that this system will build whether this is a good job match or not. The need to move with speed, the need to optimise efficiency, the need to automate things and I feel that HR is ready for that. We need to revolutionise and need leaders willing to change that.

In terms of the readiness of HR to transform, Participant 3 suggested that at the corporate and labour level "99% of HR processes are transactional. The time you clock in is superficially transactional. How do we control our human worker bees? In most instances there is very little actual strategic planning around human capital."

In response to the relevance of the degree as a minimum requirement for employment, Participant 6 suggested that a different approach is required to recruitment:

> We need to look differently into how we hire and say what are the skill sets that this person brings and not what are the educational qualifications of this individual. We need to look at how a person thinks, how a person learns and knows at a [particular] point in time.

When responding to the same question as Participant 6, Participant 9 suggested that their organisation needs different systems to identify potential "If it means practical assessments to identify potential and be able to grade those people then that will assist." Participant 7 had the following to say on recruitment strategies:

> A candidate who got an A for maths and English, would be considered to have a high degree of learnability and therefore should not have difficulty acquiring skills for the 4IR. However, if an organisation had to decide between an A candidate and a candidate who received a C in maths who had developed an app that resolved a community problem, then the C candidate would be considered the best candidate for the job.

Participant 7 suggests that the reason the 'C candidate' is a preferred candidate is because they acquired the relevant skills for the 4IR and that is what differentiates them from the 'A candidate'. Additionally, Participant 7 focussed on the role of stakeholders in preparing the workforce for career changes in Industry 4.0:

> Everyone speaks of HR, retail and finance, becoming an accountant and becoming an engineer, but what are 4IR roles and how are we driving that? Are recruitment agencies aware of the 4IR roles or is it only corporates who are leading this?

The theme ‘talent management’ detailed the role of HR in implementing the appropriate strategies to function in Industry 4.0. Participants 1, 2, 3, 4, 5, 6, 7, 9 and 11 gave their input of what needs to happen to prepare the workforce for anticipated changes for the new world of work. Some participants felt that HR needs to have a greater strategic role in the development of the workforce for the new reality. Participant 2 felt that they are ready to explore alternative development methods, but the challenge is with organisational leaders. Participant 9 echoed the sentiments that they are ready to embrace efficient systems, but stakeholders are cynic of the recommendations.

4.5 Data analysis related to the second objective

The second objective of the study identified the skill sets required by the workforce to function in the 4IR. According to Hecklau, Galeitzke, Flachs and Kohl (2016), most authors categorise competencies into four main groups: technical competencies, methodological competencies, social competencies and personal competencies. The researcher used the four competencies to represent the four themes to report the skill sets required to address the second objective. The skill sets identified were further clustered into sub-themes using the core competencies used by Hecklau et al. (2016). The four themes and the sub-themes relevant to this study are shown in Table 4.3.

Table 4.3: Data analysis related to the second objective

Second objective	Theme	Sub-theme
Skill sets required to function in the 4IR	4. Technical competencies	• Technical skills • Coding skills
	5. Methodological competencies	• Creativity/innovation • Data analysis • Problem-solving • Critical thinking
	6. Social competencies	• Team building skills • Communication • Human skills
	7. Personal competencies	• Cognitive flexibility • Self-development

The second objective is an extension of the 'training and development' theme that was introduced in section 4.4.2. The role of organisations and other stakeholders in creating an enabling environment for continuous learning and skills development was central to the theme. The theme 'training and development' offered the solution of upskilling the workforce to deal with career changes, but it did not reveal the competencies required to function in an Industry 4.0 environment. The aim of the second research objective is to identify the requisite skills required to function in the changing world of work.

Participants were asked to recommend the relevant skills required to function in the 4IR. Some prominent companies suggest that a degree does not prepare young employees for the workplace of the future and have thus reviewed their minimum requirements to include non-degreed individuals who possess the skills to get the job done (Sivaram, 2019). Given the role of training and education in addressing competence gaps, the researcher asked participants for reaction to the example provided by asking their opinion on the relevance of qualifications in preparing the workforce to function in the new world of work. Those responses form the basis for some of the recommended skills and are herein included.

Many participants offered suggestions for school subjects that should be introduced from the basic education level. Moreover, other participants indicated the relevance of existing subjects in acquiring the relevant competencies for the digital economy. Some school subject recommendations are included as reported and have thus not been grouped according to a specific skill set.

4.5.1 Theme four: Technical competencies

The theme technical competencies comprise the sub-themes technical skills and coding skills. In the context of this study, some participants distinguished digital literacy from coding skills. For ease of categorisation, the researcher used this distinction to divide the sub-themes into technical skills and coding skills.

Participant 1 stated the need for an overhaul of the traditional schooling system and suggested mathematics and programming as critical skills to develop technical competencies. Similarly,

Participants 2 and 7 advocated for mathematics and coding skills for learners. According to Participant 7, future leaders will have coding as a core skill as the coding language requires an understanding of "if-then statements" which is an example of a loop in introductory programming. Participant 7 further suggested that "maths literacy should not be offered in South Africa; it should be formal maths." The following extracts corroborate the respective recommendations of participants:

> Introducing programming at grade 9 is too late. Programming needs to be introduced as early as 5. They don't need to start off programming complicated things, but they can start with games. Games allow them to start solving problems. And number one, maths needs to be put as a basic for everyone. There's always that argument that certain disciplines don't need maths, but maths allows you to navigate a lot of disciplines, even if you're in the legal field (Participant 1).

> You'll need mathematics which is a very big thing because you will not be able to do coding [and] you will not be able to do robotics … The world of work inherits people who've gone through basic education and higher education. We need kids who love coding, who love technology and who love mathematics (Participant 2).

> To do IT101, you don't need to do have a matric certificate with an A in maths. You could probably do away with what SA calls maths literacy and in high school instead of maths literacy, pick up IT coding (Participant 7).

Participant 5 suggested the introduction of a subject on technology at schools. Furthermore, they suggested that advanced computer literacy was imperative to function in the 4IR "I think for me systems thinking is a skill set, thinking from a systems perspective. Systems programming is also important. The ability and knowledge to operate different systems, I'm talking about IT." Participant 6 expressed the following on technical competencies, "I think the basic one is the understanding of the technologies because computers will be able to do what we do much faster." The participant further stated how education is changing by reflecting on the future-focussed school environment of their child, "They're teaching them how to structure something from an

idea to implementation, they're teaching them how to build 3D printing machines. It's things we would have only learned at technical college or once we've graduated high school."

Participant 9 noted transformation at schools by mentioning that smartboards and tablets have been introduced to develop the technical skills of learners and educators. Reflecting on the challenges in their work environment, Participant 9 said "What is required is for people to acquire the necessary IT skills so that they can move away from the manual system to an electronic system." Participant 11 noted the disparity between private and public schools:

> From a schooling perspective government basically [must] mandate digital learning. The fact that in private schools you're able to use iPads means that kids in that area are going to be far more advanced and developed … kids regardless of where they come from [should be] able to use computers by the time they get to grade 10.

Participant 11 also reflected on how connectivity has created opportunities for people to earn a living online without formal qualifications. "For me knowledge is not so much the qualification but being able to serve a particular expertise." Following Participant 11's view of opportunities that have been created, Participant 10 illustrated how digital technology has opened the platform of learning and connectivity "I think our labour market, there's lots of gaps that we need to [address] from a skills point of view. There's no excuse now that I can't learn, I need to be at school, I need to be at college because mobile technology has put the power in our hands." Participant 3 focussed on the difference in technical competencies required between low skilled workers and white-collar workers by reflecting on the mining industry:

> These are basic digital literacy questions, like how [you use] a tablet, is obvious for us. But I think for a lot of low skilled workers … the actual operator does not necessarily have the same levels of digital familiarity than what I have as a white-collar worker. So general technological and digital literacy will become an increasingly important capability in order to use modern technologies effectively ... Now you can't just be a water treatment expert, you also need to know about cyber security. You also need to know about some social

> commutes and engagement process and then you need to know some law and then you need to know like 8 different disciplines.

Most participants (Participants 1, 2, 5, 6, 7, 9 and 11) state that the introduction of technology at the basic education level is vital to the development of technical competencies to function win the new world of work. Participant 10 focussed on how mobile technology allows us to acquire knowledge on the go. Participant 3 highlighted the different type of technical skills required by comparing a blue-collar worker to a white-collar worker. Based on the responses, the technical competencies are critical to function in the 4IR. However, some of the respondents indicated that soft skills are more important for this era.

4.5.2 Theme five: Methodological competencies

The theme methodological competencies encompass the sub-themes data analysis skills, problem-solving skills, critical thinking skills and creativity. For categorisation purposes, participants who used synonyms associated with creativity were included in this sub-theme.

Participant 1 used Mark Zuckerberg to illustrate how young minds are changing the world of work through technology and data analysis. A description of how human behaviour is assessed from the browsing experience was provided. Participant 1 also asserted that:

> Because of access to information. He who owns data owns the world. If I've got data, I've got information, I can control the world. As far as technology is concerned and how it will evolve, the jobs that will be created will be because of curiousness.

Participant 2 suggested that the 4IR requires workers to use data driven problem solving. Participant 2 supported their suggestion as follows:

> The levels of work and job complexity requires critical thinking … another skill you would need in order to function in the 4IR. Education opens you up in terms of analytics, in terms

> of critical thinking. If we're going to begin saying that education is not necessary, it means that whatever that forms the content of whatever we develop in education is wrong.

Participant 3 also defended the role of formal qualifications but focussed on professions that require scientific knowledge "there will always remain critical skills that [require] external validation and qualifications are critical for that". The participant provided an example of practical methods to assess essential capabilities and included methodological competencies:

> You can automate coding tests like in consulting for example, I can test your logical analysis skills by giving you a GMAT program…There's a lot of complex problem solving, and there's a lot of fuzzy data to deal with…Not so much AI, but the use of big data informs our ability to identify patterns, identify connections between different market drivers. So really, big data augments our ability to create useful insights.

Participant 6 highlighted future-focussed skills being taught in some schools "They're teaching them how to solve complex problems …They need to teach these kids how to think critically and how to love learning." The participant also compared the critical application of what they were taught at university "they should have taught us how to think critically, problem solving and how to learn because most of us are doing things that we didn't learn in varsity". Participant 7 suggested that new roles require psychology and analytical technical skills. The example provided was that of data scientists in schools in parts of America, China and Europe also being trained in psychology. Participant 7 explained the role of psychology as follows "So Google through psychology will do what they call a customer journey or CX or UX, so these skills require an understanding in the client's psychology … the customer's pain points." Other future focussed skills were mentioned:

> People with skills that are largely analytical ... Because the concepts required, the analytical skills required to get an A in maths in matric might not be the same as the cognitive and analytical skills required to code by the time you leave matric (Participant 7).

When responding to the relevance of qualifications, Participant 8 said their organisation does not hire individuals based on qualifications, but rather on their problem-solving abilities which can be tested through practical assessments. “If you can solve a problem, you’re hired. So, we’re developers, so for me all my developers went to school, but I know there are great developers out there who can program but they don’t have a tertiary qualification.” Like Participant 7, Participant 8 also included the role of psychology in the new world of work. Other methodological competencies were suggested and are included in the following extracts:

> I think we need to have a subject called innovation. It mustn’t be mathematics or science based … It must be how to think, how to solve problems, how to work under pressure and how to solve practical and psychological problems. Psychologists are the right people to be leading this process in terms of training because they help you think differently about problems (Participant 8).

> Now we focus on how we analyse. AI is all about analysing information that we don’t have … Right now, we’re analysing information that is there. Now we need to think about analysing information that is not there. But, what do we do? We use history to determine the future (Participant 8).

In addition to suggesting innovation as a subject at school, Participant 8 stated that people “must think outside the box” to compete in this era. In terms of creativity, Participant 1 suggested that people need to be “out of their mind” to allow them to innovate. Likewise, Participants 4, 9, 10 and 11 concurred that people should be allowed to be innovative. Participant 9 proclaimed “if you’re not broadminded and do not have that creative spark in you, in the 4IR you’re going to be left behind and struggle because with technology you need to be able to move with speed.” Participant 2 concurred that the 4IR requires innovators and referred to the core characteristic of broadmindedness as an essential methodological competence.

Although the work environment of Participant 10 already consists of employees with the skills required for Industry 4.0, they acknowledged how new technologies have disrupted various

industries and contended that the methodological competencies needed are complex problem solving, critical thinking and data analysis. Participant 11 noted the following:

> I think they need to be analytical. You [must] be able to understand information because data in the future is what is going to propel the 4IR. Number two, they [must] be able to solve problems. Problem solving is one of the core attributes of the 4IR because if you look at the companies that have been really successful are those that have identified a problem. Like Uber has been a problem-solving innovation.

When addressing the technical competencies required for the 4IR in section 4.5.1, Participant 1 mentioned how games can be used to develop problem-solving skills. Similarly, Participant 5 mentioned systems thinking which is associated with problem-solving. For the methodological competencies, problem-solving skills was the most critical skill reported by most participants (Participants 1, 2, 3, 5, 6, 8, 10 and 11), followed by data analysis skills (Participants 1, 2, 3, 7, 8, 10 and 11) and creativity (Participants 1, 2, 4, 8, 9, 10 and 11). Although critical skills were the least mentioned methodological competency, it was reported in this study as it is deemed to be crucial to function in Industry 4.0.

4.5.3 Theme six: Social competencies

The theme social competencies incorporate the sub-themes team building skills, communication and human skills. The customer centric aspect of the 4IR was a theme highlighted by many participants. People skills were identified according to the participants' interpretation of interpersonal skills required for the 4IR. Moreover, the researcher broadly categorised the social competencies according to their understanding of customer centric interaction skills. For the purposes of this study, language skills, emotional intelligence and people management skills are examples of some of the skills classified as human skills.

Participant 1 reflected on their background in a technical environment and how they have had to adapt to managing people in this complex environment. Participant 2 emphasised the importance of social competencies through human skills:

> Yes, we can measure your IQ, but it's not going to give you emotional intelligence, agility, it's not going to teach attitudes, people management and it's not going to teach you empathy, and those are the skills we need right now in whatever type of job a person is working in (Participant 2).

Similarly, Participant 9 mentioned emotional intelligence and interpersonal skills as being critical human skills required in interfacing with clients and managing them. Participant 10 emphasised that humans still matter as robots do not have emotional intelligence.

Participants 7, 8 and 10 focussed on the customer-centric skills required of IT professionals in the new era. Participant 7 illustrated their position, "The 4IR is not requiring the IT person who used to sit in a corner being an introvert and just code. [It] requires the developer to work with the customer to come up with an agile solution." Moreover, Participant 7 mentioned that conversational skills are required for Chatbot trainers to train robots on their interaction with customers. Participant 7 also advocated for the learning of languages and suggested that multilingualism is a key future-focussed skill. Participant 8 outlined how their high impact environment requires them to sell and deliver quality concepts to their clients, "It's how you explain your vision to them." Participant 8 also revealed that patience is required in interacting and understanding their clients' requirements to deliver solutions. According to Participant 10, customer service orientation and people management capabilities are additional requirements for IT professionals. Participant 6 highlighted the social skills aspect of the 4IR by saying that people need to understand how humans interact and behave by suggesting that people require "different types of skills that will help them deal with people that will give them social skills".

Participant 1 reflected on the role of team building by referring to the benefits derived at university "We'd come together as a team and assign each member a concept and then come together to discuss. In a short space of time you were able to capture more than if you'd done it yourself." Based on their positive experience of teamwork, Participant 1 advocates for teaching children to work in teams rather than focus on competing from an early age. Participant 6 also supported the notion of children learning to work in teams at school. Participant 2 illustrated the role of team building skills in contributing to the development of an employee in the workplace by referring to

the profile of a talented employee in this era "Now talent in the 4IR is about collaboration …We are looking for people who are collaborative." Participant 10 also listed collaboration and coordination as a key construct to function in this work environment. Participant 7 declared that "collaboration will become a key requirement". Participant 8 corroborated the collaborative role of developers "in our world you never find someone who is a perfect match, they always specialise … So, what we do is make the team complement each other".

In reporting on the dominant social competencies, it is important to note that the sub-theme 'communication skills' was based on the subjective views of what communication entails. The sub-theme communication skills thus mentioned several competencies from Participants 1, 2, 6, 7, 8, 9 and 10 that the author deemed to be associated with communication. Furthermore, the author categorised various examples provided by participants as human skills. The sub-theme of team building skills was easier to categorise with Participants 1, 2, 6, 7, 8 and 10 providing examples of the importance of the social competence.

4.5.4 Theme seven: Personal competencies

The theme personal competencies include the sub-themes cognitive flexibility and motivation to learn. For categorisation of cognitive flexibility, terms such as adaptability and self-awareness were used to interpret participants' responses. Motivation to learn will consider relevant interpretations of self-development. The core elements referred to the control individuals have in directing career progression through learning and their goal orientation.

Participant 1 stated the ability of the youth to adapt to technological advancement better than the older generation as an advantage for Industry 4.0. Participant 2 referred to cognitive flexibility "A skill set that you'll need is people who are comfortable with technology, who are agile … the ability to adjust." When responding to what constitutes talent in the 4IR, Participant 3 said "I think adaptability will probably be the most important characteristic of a talented employee."

Participant 6 referred to how people have adjusted to technological advancement by using the example of Nokia "If you're going to hold on for the sake of not wanting to change, you'll become obsolete." To demonstrate cognitive flexibility, Participant 7 used the typewriter as an example of

an outdated skill due to technological progression. Participant 9 stated "If you're resistant to change or adapting then you'll be left behind and have serious challenges in the 4IR." Participant 11 provided an example from their work environment on adaptability:

> For example, in my specific area product managers have a core competence but they are used to doing things in the traditional way but I'm not going to lose them because they have an engineering capability. But it's about how I'm really going to help them to adapt their capability … in a manner that embraces digital tools.

Finally, Participant 10 was the only participant to suggest the construct of self-awareness "Do things with a degree of self-awareness and leadership impact on others".

Participant 1 expressed their views on self-development in the 4IR "It's going to incrementally need you to teach yourself." Similarly, Participant 8 reflected on the locus of control "you need to control your own destiny to be able to determine your future. Now a lot of people still have this trust of other people". Participant 2 stated the following on motivation "If you tap into what a person is passionate about, you can invoke some higher purpose." Participant 4 stated that individuals need to be proactive in identifying growth opportunities in the workplace "I think I'm not best suited here, my interest is in this area. Can you please give me this opportunity to go there and learn?" Participant 6 highlighted the motivation to learn "We need to equip the younger generation and ourselves to have the desire to learn new skills."

Participant 9 referred to the talent profile of an individual in the 4IR as being focussed and a risk-taker. Furthermore "If the person is not a go-getter in the 4IR that person will be left behind". Participant 10 referred to self-learning as one of the capabilities required for talent. Like Participant 9's view of being a risk-taker, Participant 10 mentioned that people need to be responsible for their actions "Be brave and courageous to try new things … getting more courageous around pushing the boundaries on doing other things." Participant 11 emphasised the role of individuals in up-skilling themselves "If you're in a job today that is not teaching you to operate in the new digital era, then you need to start equipping yourself with those skills."

Cognitive flexibility and the motivation to learn emerged as equally important personal competencies. Participants 1, 2, 3, 6, 7, 9, 10 and 11 provided examples for cognitive flexibility as a key skill to function in the 4IR. Similarly, Participants 1, 2, 4, 6, 8, 9, 10 and 11 cited the motivation to learn as integral to personal competencies.

4.6 Data analysis related to the third research objective

The third research objective investigated what government can do to mitigate the perceived effect of the 4IR on job losses. The themes that emerged for this section were entrepreneurship and policy and legislation. Entrepreneurship was further divided into two sub-themes as shown in Table 4.4.

Table 4.4: Data analysis related to the third research objective

Third objective	Theme	Sub-theme
To investigate what government can do to mitigate the perceived effect of the 4IR on jobs	8. Entrepreneurship	Training Empowerment
	9. Policy and legislation	

Since the third research objective deals with recommendations for mitigating the perceived effect of the 4IR on jobs, it is important to note that when given an opportunity to present their general perspective on the impact the 4IR, most participants (Participants 1, 3, 4, 5, 6, 7, 10 and 11) were adamant that although there may be some job losses, new opportunities will also be created. Since opportunities were discussed in section 4.4.1 under the sub-theme of change management, this section will focus on the themes of entrepreneurship and policy and legislation.

Education, training and development is a recurring theme throughout the research objectives. Training and development were offered as a solution to address the first research objective and dealt with preparing the workforce for career changes across occupational boundaries. In relation to the second research objective, education was offered as a solution to equip the workforce with the requisite future-focussed skills associated with the 4IR. Recommendations for government

were included across the themes technical competencies, methodological competencies, social competencies and personal competencies in the respective sections 4.5.1, 4.5.2, 4.5.3 and 4.5.4. Although the third research objective deals with recommendations for government, the subject recommendations at school level were reported under the second research objective. The topic of education, training and development in this section will focus on entrepreneurs.

4.6.1 Theme eight: Entrepreneurship

The theme entrepreneurship encompasses the sub-themes training and empowerment. Entrepreneurship was a popular solution for government to mitigate the impact of the perceived job losses due to automation. Participants offered training as a solution to prepare those at risk of being displaced due to technology. Furthermore, the sub-theme empowerment was based on the observation of some entrepreneurs and corporates on how best to assist aspiring entrepreneurs and small businesses to be sustainable. Some of the opportunities for empowerment serve as recommendations for government and have thus been included.

Participant 1 mentioned that there is an over-reliance on government to assist and suggested that entrepreneurs are there to augment the efforts of government. The participant said that the mandate of government is to facilitate good decision making and used the competition amendment bill as an example of how government is developing young emerging entrepreneurs through that bill. Moreover, Participant 1 expanded on their opinion of how entrepreneurs can assist government with job creation in the 4IR:

> Government, private sector and entrepreneurs all these three working together: entrepreneurs creating opportunities, government puts in the legislative frameworks for us to thrive and the existing private sector equips us to start transitioning these small businesses to sustainable businesses. We could go to the government and say we need this legislation changed so that it allows us to compete in the digital era.

Another issue raised was that of financial requirements for entrepreneurs and the incentives on offer “We do have incentives, but they’re only geared towards manufacturers. Firstly, there should be incentives to say if you do this, you don’t get taxed as a small company.” Participant 8 suggested

finance and entrepreneurship training as the requisite tools to empower individuals venturing into business.

Like Participants 1 and 8, Participant 5 felt that the workforce is dependent on the government to provide jobs. The participant highlighted the role of business in job creation "It's important to note that government doesn't necessarily create jobs, organised labour doesn't create jobs, business creates jobs." Participant 5 highlighted the importance of interrogating the type of jobs created by proposing that social partners consider their relevance in terms of economic development and the 4IR "In terms of workforce readiness, we're talking of sustainability. Are these jobs sustainable?" The outcome of research conducted by Participant 5's organisation was to incorporate the International Labour Organization (ILO) recommendation 204 which speaks to the transition from the informal economy to the formal economy. Further recommendations related to assistance for workers at risk of being displaced and entrepreneurs.
Additionally, Participant 5 illustrated how the youth could be equipped for entrepreneurship roles:

> The Compensation Fund has programs where they provide bursaries to partners and children of those who lost their lives to illnesses contracted in the line of duty. That money or programs afforded to them also assist in supporting youth to immerse themselves in entrepreneurship or programs for the new world of work as defined by the 4IR. There's a number of entrepreneurship initiatives across government and National Student Financial Aid Scheme (NSFAS) as well but I don't have examples now, but in terms of the … principles, that's what the resolutions entail.

Participant 3 was opposed to entrepreneurship as a solution for workers who have just been displaced as "Entrepreneurship is a great way to destroy a lot of capital." However, they recommended entrepreneurship programs and support for individuals who want to become entrepreneurs. Participant 3 stated "My view is how do we grow the middle sector of the economy and make them more competitive? In that way they can absorb way more labour than just everyone becoming an entrepreneur." From a sustainability perspective, Participant 3 suggested that mid-size companies probably have a viable business plan and thus have a level of resilience in a turbulent economy.

Furthermore, Participant 3 mentioned the impact of the gross domestic product (GDP) contracting by 3.2 percent and suggested that given the current climate government could play more of a mediator role to understand the institutional constraints that organisations face. Moreover, Participant 3 advocates for progressive labour legislation for business owners as follows:

> I'm not aware of the research that the Department of Labour has done to actively inform effective human management strategies. As a simple example, technically if I train my staff, they have to pay income tax as a fringe benefit. Like it makes no sense to me. I'm investing in people to improve their skills, and they have to pay tax on the skills that they receive.

Participant 6 heaped praise on the science and technology sector with emphasis on the quality raw science capabilities and output produced from South African institutions. Furthermore, the participant specified the contribution of their organisation through their investment in the production of high-quality research. Participant 6 did however critique the missed business opportunities:

> I think the missing link is how we take that research and make it into commercial products and processes. It's to take our researchers with a business mind-set, to say we've developed this unique block chain technology or AI technology, how do we turn it into a business? A lot of ideas end up as patents or they end up as journal articles or as PHDs, but we don't take that stuff and turn it into real money.… It's about taking a South African intellectual property (IP) and turning it into a South African success story.

Participant 10 focussed on the role of government:

> Well I think we'd be mistaken to think that jobs of the past in their current form are going to exist as seen with the economy, yesterday the GDP is down 3.2 percent. So [government must] propel the economy. Educational bodies and organisations there is an obligation to provide learning opportunities but also for people to be brave and courageous to try new

> things and become more entrepreneurial. Entrepreneurs in terms of technology need to go into other trades.

Participant 11 suggested that South Africa has not inculcated a culture of self-employment. Participant 11 illustrated how encouraging entrepreneurship could create jobs through the small-to-medium enterprise (SME) engine instead of the workforce being reliant on core job market. On the role of government, Participant 11 stated "conversations are around corporates cutting jobs, but the conversation should be how [corporations can empower] small business to thrive and grow." Furthermore:

> Now we have a black economic empowerment (BEE) scorecard but one of the things we need to start focusing on is having an automation strategy that allows businesses to come up with solutions to continue creating employment. But through education along with the unions you could create that understanding. The transformation strategy could be to be your own boss and I think that involves a lot of education and training (Participant 11).

Although some participants felt that there is an over-reliance on government for jobs, participants acknowledged their role in policy formulation. Some of the participants highlighted that there are opportunities for existing organisations to expand thus alleviating the burden on government to absorb displaced workers. It does however involve government implementing progressive policies for growth. Entrepreneurship as a mechanism to address job losses was supported by Participants 1, 3, 5, 6, 8, 10 and 11. However, some participants suggested that entrepreneurs be offered the requisite training and support to create relevant opportunities for empowerment and sustainable development

4.6.2 Theme nine: Policy and legislation

The theme of policy and legislation focuses on government as a policy driver and the macro-environmental factors that impact policy and legislation. Furthermore, it incorporates challenges experienced by participants through solutions for creation of jobs.

Participant 1 suggested that the internet is no longer a luxury, so government needs to facilitate access for everyone as a basic need. Additionally, Participant 1 suggested that in the future there will be an AI bill of rights because the lines are currently blurred in terms of what our rights are in terms of technology.

Participant 2 focussed on the skills gap issue of South Africa by suggesting that the government needs to introduce policies for accelerated development for adult learning. Furthermore, Participant 2 noted the need for government to collaborate with their strategic partners:

> Another thing they need to do is go back to [organisation] and talk to their partners about what the 4IR means to them and what it means to South Africa (SA) from a transformation perspective because 25 years later we are still talking about transformation after democracy.

Participant 5 highlighted the learning opportunities and the labour activation programs available through the various SETAs, NSFAS and other government vehicles aimed at assisting the workforce gain the requisite skills to function in the event of losing a job. Participant 5 focussed on the content of the courses provided by these bodies by highlighting that they have a duty to ensure that the programs enhance the economy and that the skills acquired by learners involve 4IR technological advancement. Furthermore, Participant 5 suggested that another opportunity for government is that of an integrated system using AI. Participant 5 hopes that in the future the system will be able to extract the data of unemployed individuals through their data without the affected individuals going to present themselves to the Department of Labour.

Participant 7 advocated for greater involvement by government through labour business forums that are in existence:

> We approach the SETA and we will approach the union on the 4IR, and we will say, 'these are the skills required for the 4IR.' So, changing our policies, practices our legislation to be globally competitive and for everyone, even corporate South Africa, should look at the competitive report and say for your industry how competitive are you?

Although Participant 8 disapproved of reliance on the government for solutions, they acknowledged the socioeconomic factors that have created a gap "between the haves and the have nots" and thus accepted the crucial role of government as a policy driver. From a legislative perspective, Participant 8 referred to how third-party information is governed by the protection of personal information (POPI) act and the implication for organisations. Besides the fact that the subject of POPI keeps on changing, the cost implications for organisations is that they must increase their cyber security budget to adhere to the act.

According to Participant 3, further factors that need to be tackled by government are the infrastructure challenges which impact businesses such as a shortage in power supply which has cost implications for the manufacturing environment reliant on a stable power supply. The lack of a 5G network to enable "massive increase in huge transfer of data" is another challenge mentioned by Participant 3. Finally, the participant stated, "I think a lot of the infrastructure questions are not there in SA. They need to be addressed before we can fully take advantage of 4IR type programs." Furthermore:

> All these changes in society and changes in the economy will increasingly require completely new business models in terms of how we respond to them for a market point of view and that in turn requires a completely new set of skills to operate in those corporates. So just as much as we don't necessarily understand the financial capital side of things in terms of this whole environment, we have these financial issues, which are similar in terms of the human capital issues (Participant 3).

Expanding on the infrastructure challenges expressed by Participant 3 around the lack of a 5G network, Participant 11 suggested, "the government needs to enable for spectrum. Spectrum allows for ubiquitous connectivity and with ubiquitous connectivity, we can access digital technology." Furthermore, Participant 11 lamented the slow pace of transformation "we've been trying to move from analogue to digital for over 10 years and other countries have evolved a long time ago." The participant mentioned the jobs that can be created through the internet and suggested that government has the greatest opportunity to grow small businesses:

> I've seen from other countries and case studies quite a lot of those challenges have been solved through technology. I think we're talking about these challenges, but we won't grow if we don't transform to use the 4IR to propel our growth.

Participants 1, 2, 3, 5, 7, 8 and 11 mentioned macro-environmental factors which are impacting growth in organisations. Although the recurring theme of skills development was highlighted, Participants 5 and 7 suggested that government should focus on including globally competitive policies aimed at creating an environment for growth. A further suggestion was made for government to make use of available data to improve the customer experience for unemployed individuals. Finally, Participants 1, 3 and 11 mentioned the opportunities available through the digital economy but lamented the delay in progressive policies and legislation from government.

4.7 Summary of chapter

This chapter presented a detailed overview of the research results based on the analysis of the perceptions and experiences of organisational leaders from three core perspectives: HR, business partners to HR and society. The research addressed the readiness of organisations to prepare the workforce for career changes associated with Industry 4.0. Additionally, the skills deemed crucial to function in the new world of work were identified. Furthermore, the role of government in mitigating the job losses due to the 4IR were explored.

The researcher used the four phases to thematic and content analysis as proposed by Vaismoradi et al. (2016) to identify the themes and sub-themes for the study. The results of this study yielded nine themes and twenty-four sub-themes. The nine themes identified were: (i) change management; (ii) training and development (iii) talent management (iv) technical competencies (v) methodological competencies; (vi) social competencies (vii) personal competencies (viii) entrepreneurship (ix) policy and legislation.

The analysis of participants' perspectives and the themes that emerged provided guidance for the discussion in the next chapter. The recommendations that emerged from the themes are compared

to the literature reviewed. Chapter 5 concludes with the limitations of the study, recommendations and proposals for further research.

CHAPTER 5

DISCUSSION, CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

5.1 Introduction

This final chapter presents the discussion, conclusions, limitations and recommendations arising from the study. The 4IR is an important phenomenon to explore due to its expected impact on careers across industries. The aim of this exploratory study was to address the paucity in research on the impact of the 4IR on talent management in selected South African organisations. A summary of the preceding chapters contextualises how each chapter contributed to addressing the research questions. Moreover, this chapter encompasses five main sections, namely, discussion of (1) the achievement of research objectives and questions, (2) summary of research findings, (3) discussion of the research findings, (4) the theoretical and practical contributions of the study and research limitations, and (5) recommendations for future research.

5.2 Achievement of research objectives and questions

The purpose of the present study was to explore the phenomenon of the 4IR through evaluating the impact of artificial intelligence on talent management with focus on the South African context. Organisational leaders from selected South African organisations were interviewed to address the current knowledge gaps in human resource and management research as follows:

1. How do organisations prepare the workforce for multiple job changes across occupational boundaries in the emerging 4th industrial revolution?

2. What skills sets will the workforce require in order to function effectively in the 4th industrial revolution?

3. What can government do to mitigate the perceived effect of the 4th industrial revolution on job losses?

The following research objectives were identified to address the research objectives:

1. To evaluate how organisations are preparing their workforce for multiple job changes across occupational boundaries in the emerging 4th industrial revolution.
2. To identify the skill sets that would be required by employees in order to function effectively in the 4th industrial revolution.
3. To identify the role of government in mitigating the perceived effect of the 4th industrial revolution on job losses.

The theoretical framework that informed the study was developed by drawing upon innovation management through Disruption Theory and understanding how the career process is shaped through the Career Development Theory of Chaos. To further address the study objectives, academic literature pertaining to vocational psychology such as the Protean and Boundaryless Career Models were also explored in the literature review (Chapter 2). During the empirical phase of the study, data was collected by means of eleven semi-structured interviews of organisational leaders from selected private and public sector organisations. The results of the study were obtained through the analyses of data using the four phases of thematic and content analysis by Vaismoradi et al. (2016) and presented in Chapter 4.

5.3 Summary of research findings

This study used a qualitative method and a cross-sectional design to explore the perceptions of eleven purposively selected organisational leaders from various organisations and industries to address the research phenomenon. Nine themes and twenty-four sub-themes emerged from this study and are herein outlined.

The first research objective was to evaluate how organisations are preparing their workforce for multiple job changes across occupational boundaries in the emerging 4IR. The first theme from the research findings as detailed in Table 4.2 of Chapter 4 was change management. Furthermore, the sub-themes that emerged were communication, stakeholder collaboration and education. The research findings identified the change management process as being essential to workforce readiness for the future workplace. However, it requires stakeholder collaboration to educate the workforce of the career opportunities of the 4IR through an effective communication strategy.

Training and development were the second theme with the four sub-themes of continuous personal development, stakeholder/ organisation initiative, the learning organisation and the higher educational system emerging from the research findings. The sub-themes involved the role of all stakeholders in creating an enabling environment for continuous learning for the future workforce so that they are prepared for contemporary careers in the VUCA world of the 4IR. Finally, talent management is the third theme that emerged with four sub-themes emerging from the research findings, namely: organisational culture, recruitment and selection, job redesign/ rotation and flexi-time work arrangement. The focus was on human resource practices and the practical implications for organisation leaders to effect the required change to empower the workforce to function in the 4IR.

The second research objective aimed to identify the skill sets that would be required by employees in order to function effectively in the 4IR. The fourth theme emergent from the research findings as detailed in Table 4.3 of Chapter 4 was technical competencies. The technical competencies theme comprised the sub-themes of technical skills and coding skills which are crucial skills for the workforce. Methodological competencies were the fifth theme that were identified as being vital to function effectively in the 4IR, with the sub-themes of creativity/ innovation, data analysis, problem-solving and critical thinking skills herein included. Social competencies are the sixth theme named and included the skills of team building, communication and human skills as sub-themes. Finally, personal competencies are the seventh competency required by the workforce of the future to function in the 4IR and comprised the sub-themes cognitive flexibility and self-development.

The aim of the third research objective was to identify the role of government in mitigating the perceived effect of the 4IR on job losses. Table 4.4 of Chapter 4 detailed entrepreneurship as the eighth theme in addressing how government can mitigate the perceived impact of the 4IR on job losses with the sub-themes of training and empowerment emerging from the research findings. The ninth and final theme to emerge from the study was policy and legislation, with macro-environmental factors being discussed as per Harvard Professor Francois Aguilar's 1967 PEST analysis.

5.4 Discussion of the research findings

The summary of the research findings in Section 5.3 provided a synopsis of the themes and sub-themes that arose in the present study from Chapter 4. This section details how each research objective and question was achieved in terms of the outline presented in Section 5.2. The findings were discussed within the context of existing literature.

5.4.1 Discussion of findings for the first research objective

5.4.1.1 Change management

The theme change management is comprised of the sub-themes of communication, stakeholder collaboration and education. As discussed in Section 4.4.1, communication broadly discusses the communication strategy, whilst stakeholder collaboration focuses on the role of organisations in preparing the workforce for the career changes associated with Industry 4.0 through strategic and social partnerships and finally education through informing the workforce of the opportunities of the 4IR.The research finding in this study indicated that the message around the 4IR is around job losses. The career opportunities that are available and the benefits of productivity and efficiency are not being communicated, thus creating unease amongst the workforce. Change deals with intricate and adaptive conditions where the problem statement and resolution thereof are often unclear (Leurent & Shook, 2019). According to research conducted across industries, some of the challenges related to the implementation of the 4IR are no strategic direction and limited insight of the concept, uncertainty about the benefits and associated costs of the revolution (Salkin et al., 2018). According to Kagermann et al. (2013), a comprehensive communication structure and training and continuous professional development are some of the areas that need to be considered for successful implementation of the 4IR. The solution thus requires the articulation of a clear vision which requires an authentic connection with people through empathy (Leurent & Shook, 2019). The transformation challenges are limited knowledge of technologies and opportunities thereof, doubt about the gains from technology investments on processes and products, difficulties in identifying the starting point milestones of planning horizon and limited communication about the advantages of transformation projects related to the 4IR transformation projects, restricted financial resources and human capital and the allocation of scarce resources to the developments and collaboration with dependable partnerships (Sarvari et al., 2018).

Frey and Osborne (2015) suggest that public spending in these promising technologies could facilitate new job creation. Government and the community at large must therefore join forces to plan a future sustainable job ecosystem conforming to Industry 4.0 (Arntz et al., 2016). Lee et al. (2018) views the 4IR as an opportunity to boost the quality of life thus enabling individuals to work less and smarter through efficient and productive digital systems. Opportunities and openness for collaborative innovation are solutions for organisations to equate the benefits and risks of digital and industry platforms (Schwab, 2016). Section 4.4.1 of this study highlighted the opportunities that are available due to the 4IR. Besides new types of job opportunities, the research findings highlighted enhanced efficiency and productivity as hallmarks of this revolution. The research findings confirm the findings of other studies (e.g. Hermann et al., 2014; Ganzarain & Errasti, 2016; Park, 2016; Bakkari & Khatory, 2017; Connor, 2018).

Joseph Press from the Centre for Creative Leadership (2018) indicates that for organisations and individuals to survive, leaders are forced to adopt new roles for themselves and their workforce as business models that previously propelled organisations to the top of their industries are being disrupted by technology, globalisation, and demographic change amongst others. The thoughts on leadership posited by Joseph Press on innovation and survival are aligned to Schumpeter's creative destruction theory and Christensen's theory of disruptive innovation (Schumpeter, 1942; Christensen, 1997; Lepore, 2014; Bailey, 2015; King & Baatartogtokh, 2015; Christensen et al., 2015). Some indicated that those who refuse to adapt, risk becoming obsolete, thus change is integral to survival in the 4IR.The new work environment requires innovative forms of multi-stakeholder collaboration to improve organisational boundaries and continuously rethink new ways of working (Leurent & Shook, 2019).

5.4.1.2 Training and development

The theme training and development encompasses the sub-themes continuous professional development, stakeholder/ organisation initiative, the learning organisation and the higher educational system. The research findings indicated how stakeholder/ organisation initiatives such as roundtable discussions with relevant stakeholders can address the challenges associated with the 4IR. Leurent and Shook (2019) state that collaborative partnerships beyond organisational, national or industry sector boundaries encourage broader thinking. Schwab (2018) views reskilling and retraining of the current workforce as a catalyst to boosting economic growth, enhancing

societal resilience in a changing technological environment and the key to paving the way for focussed education systems for the future generation of workers. Leurent and Shook (2019) illustrated how Singapore has collaborated to transform the production training workforce ecosystem as follows:

- The government supported the development of industry transformation maps and a skills framework.
- The academic institutions modified and modularised their curricula to support the training needs of industry.
- Organised labour galvanised the workforce, which created an important bridge between government and industry to enforce upon the workforce the criticality of life-long learning.

The role of collaboration in preparing the workforce for the 4IR through training and development was discussed in innovation theory and practice through the notion of the Triple Helix model. Stakeholder/ organisation initiative and the higher educational system is an example of how synergy can be achieved through cooperation by creating knowledge via academia, business and government as the Triple Helix actors engaging one another (Steenkamp, 2019). Furthermore, the Triple Helix model encompasses Schumpeter's 1942 concept of creative destruction which is an innovation dynamic which gives rise to creative renewal through the intersectionality of government, industry and the university (Ranga & Etzkowitz, 2013).

Shook and Knickrehm (2018) suggest that skills now have a half-life of five years, so organisational leaders must be proactive in decisions affecting the workforce of the future. The findings in this study highlighted the necessity of stakeholders taking responsibility for preparing the workforce for career changes across occupational boundaries by providing opportunities for workers to continuously learn. Organisations have a role in creating an environment empowering the workforce to upskill. There are a few studies that highlight the role of stakeholders in inculcating a learning environment (Foster et al., 2015; Horwitz & Budhwar, 2015; Schwab, 2016; Shamin, Cang, Yu & Li., 2016; Stock & Seliger; 2016; Kravčík et al., 2017; Teloni, 2018). Karacay (2018) suggests that effective performance within the 4IR work environment requires a workforce that is in the practice of continuously learning outside of their occupations. O'Reilly and Tushman

(2008) view an organisation's ability 'to learn how to learn' as an opportunity to encourage exploration and exploitation, which is aligned to the concept of the learning organisation. Liker and Hoseus (2010) use the example of Toyota as a learning organisation that is successful in that the organisation works off the premise of people being the most important resource and thus need to be challenged, developed and nurtured. Hartmann (2014) suggests that the focus at enterprise level needs to focus on creating an environment conducive to innovation through participative forms of organisation, skills development and supporting learning processes to increase innovative capacity.

5.4.1.3 Talent management

The theme talent management comprises the sub-themes of organisational culture, recruitment and selection, job redesign/ rotation and flexi-time work arrangement. Organisational culture broadly discusses the policies and practices that HR needs to redefine to prepare the workforce for career changes in the 4IR workplace. The focus of recruitment and selection is how organisations needs to adapt in identifying potential candidates. Rigid work structures and work designs are some of the components discussed in Section 4.5.4 under job redesign/ rotation. Finally, in preparing the labour force for the 4IR world of work across occupational boundaries, organisations need to consider flexi-time work arrangements. HR remains a crucial function within organisations because human beings are the only competitive resource that cannot be copied (Liker & Hoseus, 2010), it is thus vital for organisations to implement HR practices aimed at talent development for the new world of work.

Considering the doubt on the existing technological transformations and the potential to create chaos for production systems and the community at large, policymakers need anticipatory intelligence to gauge and forecast the effect of the technological revolution on qualifications, work conditions and the design and assessment of innovation policies, science and technology (Kergroach, 2017). Organisations need to prioritise data collection and conduct full data analyses on their existing and future work designs, to gain insight into the roles likely to be automated per industry and the roles that may be required in alignment with ongoing automations to develop talent processes for the 4IR (Karacay, 2018).

Stock and Seliger (2016) propose increasing the intrinsic motivation and developing creativity by launching new CPS-based methods to work organisation and design. Although the scientific

interest in the technological aspects of the 4IR is gaining momentum, an understanding of the consequences of new professional roles that are likely to arise prove to be harder to grapple with due to the complexity, heterogeneity and static nature of job descriptions (Fantoni et al., 2018), which is aligned to the sub-theme of job redesign/ rotation found in this study. Furthermore, the findings indicated that some of the new job roles associated with the 4IR are known because of the organisational development role within HR, whose role it is to stay abreast of trends.

However, it is imperative to note from the research findings that not all organisations have the have the capabilities to identify talented individuals using practical assessments, which is aligned to recruitment and selection. Ariss et al. (2013) critique the selection criteria adopted by some organisations to identify individuals for talent management programs by using attributes such as being skilled and being a manager. These exclusionary systems may miss the opportunity to develop lower graded individuals with who may have gained critical skills such as innovation, technical expertise and management through instrumental roles (Ariss et al., 2013). Other studies advocate for new HR practices and policies that are reflective of the new way of work (Evans & Schmalensee, 2016; Hirshi, 2017; Kravčík et al., 2017; Morrar et al., 2017). Organisations thus need to transform their organisational culture to reflect new practices and policies that take the impact of the 4IR into consideration, as talent management is a vital aspect in human resource development for the world of work.

5.4.2 Discussion of findings for the second research objective

5.4.2.1 Technical competencies

According to the present research finding, technical skills and coding skills are vital technical competencies to acquire for the Industry 4.0 workplace. Gilchrist (2016) posited that the workforce of the future requires multidisciplined generalists with computer, mechanical and process engineering skills. A Boston Consulting Group (BCG) study reiterated the imperativeness of IT and programming skills for the individuals in Industry 4.0 (Maier & Student, 2014). The technical competencies listed in this study are consistent with those indicated by (Davies, Fidler & Gorbis, 2011, Störmer et al., 2014; Pompa, 2015; WEF, 2016; Maier &Student, 2016). It is important to report that a new subject called digital skills, that encompasses coding and robotics, will be piloted at schools from 2020 (Rivett, 2019). However, Dr Jantjies from the University of the Western

Cape highlights that the core elements that still need to be addressed for effective rollout are infrastructure, localised learning content, safety and security, teacher training and support and technical support (Rivett, 2019).

5.4.2.2 Methodological competencies

The methodological competencies that emerged from this study are creativity/ innovation, data analysis, problem-solving and critical thinking skills. A 2017 study by Pricewaterhouse Coopers suggests that reclassification of jobs due to automation will give employees with creativity and problem-solving skills a competitive advantage. Grzybowska and Łupick (2017) mention analytical, creativity, entrepreneurial thinking and problem-solving as the skills required by the 21st century workforce. The World Economic Forum (2016a) projected that critical thinking, creativity and complex problem-solving skills will be the skills requirements for 2020. The methodological competencies identified in this study such as creativity, data analysis, problem-solving and critical thinking are in consonance with those in other studies (Davies et al., 2011, Störmer et al., 2014; Morgan, 2014; Pompa, 2015; Kopp, Howaldt & Schultze, 2016; Elliott, 2017; Wilson, Lennox, Hughes & Brown, 2017; Lee at al., 2018). It is worth noting that Smith and Ruup (2004) referred to talent in the new economy of knowledge workers as innovative thinking, technical ability and high levels of customer service, which are skills associated with the 4IR which was coined in 2011. The authors further suggest that employees will be required to be globally astute and operationally agile. There are thus core competencies that remain relevant with each 'revolution'.

5.4.2.3 Social Competencies

The social competencies that were identified as being pertinent to equip workers with multidisciplinary skills in this study are team building skills, communication skills and human skills. This study classified team building skills as those interpersonal skills required to function and collaborate with other people. Section 4.5.3 described how interpersonal skills that were customer-centric and associated with communication were broadly categorised as communication skills. Human skills were broadly categorised as the language skills, emotional intelligence and people management skills. Kergroach (2017) lists management, teamwork and communication skills as other soft skills that are evident in the 4IR workplace. The skills identified by the WEF (2016) as requirements for the 2020 workforce are service orientation, coordinating with others,

emotional intelligence and people management. Other social competencies that were identified in this study are consistent with those in other studies (Morgan, 2014; Störmer et al., 2014; Gehrke, Kühn, Rule, Moore, Bellmann & Siemens, 2015; Pompa, 2015; PwC, 2017; Hecklau, Orth, Kidschun & Kohl, 2017; Teloni, 2018).

5.4.2.4 Personal competencies

The personal competencies that emerged in this research study are cognitive flexibility and self-development skills. As discussed in section 4.5.4, self-awareness, adaptability, motivation to learn and goal orientation are some of the skills categorised under cognitive flexibility and self-development. The concept of the protean self is resultant from the concept of Proteus, the Greek god who took on many identities (Lifton, 1993). The concept of the protean career needs individuals to be self-aware and proactive in acquiring the requisite skills in the new career climate (Chin & Rasdi, 2014). Chin and Rasdi further suggest that the psychological contract now includes continuous learning opportunities, personal autonomy and self awareness. Savickas and Porfeli (2012) advocate for people to adopt boundaryless and self-directed behaviours in the uncertain and changing job environment, which is crucial for career adaptability. Like Proteus, the 4IR requires individuals be adaptable in developing a career identity. Cognitive flexibility and self-development skills are skills aligned to the protean and boundaryless career and career adaptability.

Bonekamp and Sure (2015) link adaptability and flexibility with continuous learning which necessitates that individuals take responsibility for their education and training beyond what is provided by employers. The personal competencies that emerged from this research are consistent with other studies (Morgan, 2014; Störmer et al., 2014; Gehrke et al., 2015; Pompa, 2015; WEF, 2016; Kravčík et al., 2017; Hecklau et al., 2017; Hariharasudan & Kot, 2018; Karacay, 2018). According to Hamlin and Stewart (2011) the goals for human resource development (HRM) are:

- To improve individual/ group effectiveness and performance
- To improve organisational effectiveness and performance
- To develop knowledge, skills & competencies
- To enhance human potential & personal growth

The important functional areas of HRM can thus be classified as personal development (competencies), team development (collaboration) and organisational development (structure and processes). According to global executives, only twenty-five percent of their workforce is ready to work with intelligent machines (Shook & Knickrehm, 2018). Although organisations have increased their spending on intelligent technology by over sixty percent in 2016-2017, only three percent had plans to increase their investment in training the following year (Shook & Knickrehm, 2018).

The competencies required to function in the 4IR require individuals to navigate their career identities by being proactive in developing their skills. Although organisations are expected to create a learning environment for skills development, individuals must take ownership of their careers.

5.4.3 Discussion of findings for the third research objective

Government has a pivotal role in policy formulation to address the requirements for the 4IR as their decisions impact business, labour and society. The former Minister of Science and Technology of South Africa, Mmamoloko Kubayi-Ngubane (2019) recognises that the speed at which the country masters 4IR technologies could possibly define its future development. The results herein discuss the position of government in managing the perceived impact of the 4IR on jobs.

5.4.3.1 Entrepreneurship

High unemployment hampers the adaptation of the essential infrastructure for the 4IR as the tax bases are eroded (Lee et al., 2018). Thus, it is the role of government to address the concerns of entrepreneurs who are tasked with job creation. Ragazzi (2014) suggests that these government-led policies are aimed at establishing stronger ties between respective states through human talent and prompting economic growth through the upgrade of local capabilities and structuring innovative capacities of organisations.

The sub-themes emergent from entrepreneurship are training and empowerment. The research findings indicated that the role of entrepreneurs is to create jobs whilst that of government is to

generate a conducive environment for economic growth. Although the focus of the third research objective is on government, entrepreneurship emerged as a vehicle to absorb job losses. As reported in sections 5.4.1.1 and 5.4.1.2, preparing the workforce for jobs associated with the 4IR is a collaborative effort. Entrepreneurship is thus also a joint effort between government and business. Government needs to understand the challenges experienced by business so that they can implement strategies that promote sustainability. Further research findings revealed that relevant training needs to be offered to entrepreneurs to promote the growth and sustainability of SMEs.

Teloni (2018) states that in the long run, investing in skills is far less costly than suffer the consequences of lower incomes, poorer health, social exclusion and unemployment – are combinedly associated with lower skills. Frey and Osborne (2015) state that the employment impact due to intelligent machines is evident, so government must expedite a shift in mindset, investment and policies. Leurent and Shook (2019) note that no individual, organisation or country can deal with the current challenges alone, therefore communication amongst start-ups, SMEs, large firms, academia, organised labour and government is imperative. The authors further suggest that solutions arising from start-ups and tertiary institutions be tested and scaled across the value chain, whilst large firms can offer SMEs innovation partnerships focussed on increasing agility through transformations.

Further research findings stressed the importance of helping entrepreneurs from the informal economy to integrate into the formal economy. Singh (2000) suggests that a small percent of small entrepreneurs have a formal secondary school education, so most individuals in the informal economy acquire their competencies for business outside the formal schooling system through mechanisms such as apprenticeships, informal learning processes and non-formal programmes. Furthermore, other research outcomes suggested that compared to other nations in the Global South, South Africans do not have a culture of entrepreneurship. Besides training, findings suggested that government and business can help prospective entrepreneurs by informing them of opportunities associated with the 4IR. Singh (2000) suggests that entrepreneurs who operate through networks fare better than those operating alone as their network give valuable insights into new markets, new technologies and other opportunities. Although employers have a vital role in training their workers, small and medium sized organisations could require government assistance

to offer such training and achieving such cooperation is a challenge in both the global North and the global South (Teloni, 2018). Furthermore, it was also reported that there is a burden on government to provide jobs, but relevant stakeholders need to work together to find solutions to the unemployment crisis and further job losses.

5.4.3.2 Policies and legislation

The third research objective was to identify the role of government in mitigating the perceived effect of the 4th Industrial Revolution on job losses. As mentioned in Section 4.6, the research findings reinforced that despite job losses, new opportunities will arise. The focus of this research objective was government. Frey and Osborne (2015) suggest that while education may not resolve the issue of a surge in inequality, it remains a critical factor. Recommendations for government on the schooling system were discussed in the second research objective.

Based on their challenges as business owners, research outcomes in this study proposed ideas on how government can help entrepreneurs. Policy and legislation in terms of infrastructure challenges such as enabling spectrum, a decline in the GDP and the high unemployment rate were some of the macro-economic impediments to business in achieving economic growth. Research outcomes also considered inequality as a factor in the type of policies that government can implement. The research findings suggest that the advent of the 4IR could potentially exacerbate the social disparity between the rich and poor, the youth and elderly. Callaghan (2016) confirms the research findings that South Africa's high unemployment, dramatic inequality, is possibly an exemplar of the current digital divide between the Global North and the Global South, where knowledge creation and technology could, through global management practice, be intensifying inequality. Park (2016) confirms that the digital divide is severely felt by the digitally marginalised such as the elderly and the poor. Park (2016) thus advocates for policymakers to address the digital divide.

Another research finding of the study laments the slow pace of transformation pertaining to the assignment of spectrum which could address some of the socioeconomic challenges experienced by South Africa. Moroni, Ghanmi and Lewis (2018) confirm that 5G is a vital building block to

address socioeconomic challenges as it will unlock the digital economy in Europe by creating 2.3million jobs by 2025 and revenues of approximately €113.1 billion per year in four key sectors namely: automotive, energy, health and transport. According to Morrar et al. (2017) governments need to address the policy and legislation gaps to adjust to the rapid evolution of the 4IR by delivering an enabling atmosphere, safeguards and strategies that direct the future towards sustainable economic and community development and further harnesses the capabilities that the associated technologies offer for people and societies.

Although the purpose of the third research objective was to identify how government can mitigate the perceived effect of the 4IR on jobs, the outcome of the study cautioned that stakeholders are also germane to addressing the macroeconomic challenges in South Africa. A study conducted by the World Economic Forum in partnership with Accenture, revealed that sixty-seven percent of people expect organisational leaders to drive policy change instead of waiting on government (Leurent & Shook, 2019). However, each –stakeholders – i.e. academia, business, government and labour unions - have a critical role in uplifting people and building economic growth. Schwab (2015) also confirms that public-private research partnerships designed to build knowledge and human capital is beneficial to all. This is aligned to the Triple Helix system which suggests that collaboration is key to innovation.

High levels of unemployment for individuals with lower levels of education and training and a scarcity of high-skilled jobs are characteristic of the South African economy (Reddy et al., 2016). A report published by the WEF, ranked South Africa 148th out of 148 countries for the overall quality of its mathematics and science schooling system (Wilkinson, 2019). However, the report has been slammed by education experts who believes that the research methodology is flawed as it is based on the opinions of business leaders (Wilkinson, 2019). The Department of Basic Education also issued a press release branding the report as an inaccurate reflection of the education system (Wilkinson, 2019). That said, the research findings indicated that the education system needs an overhaul to train learners, so they are equipped with the vital skills for the digital economy. The relevant stakeholders thus need to evaluate if the current curricula will equip learners with future-focussed skills for the digital economy.

The Presidency recently appointed a Commission on the 4IR that encompasses industry experts from various organisations aimed at identifying the requisite action plans, policies and strategies that will enable South Africa to compete globally (The Presidency, 2019). This suggests that government is aware of the impact of the 4IR and have thus taken action to address the challenges associated with it.

5.5 Contributions of the study

5.5.1 Theoretical contribution

Although the concepts of the protean and boundaryless careers are nothing new, the role of these models in the VUCA world of Industry 4.0 are important in their contribution to theory. This study discussed the role of the Chaos Theory of Careers as it relates to the uncertainty of the postmodernist career of the 4IR. Although the CTC is prominent in career literature, Schlesinger and Daley (2014) suggest that many professionals within vocational psychology are not 'au fait' with the theory. This study constitutes a response to Barley et al. (2017), who lamented the absence of academic literature on the 4IR in career counselling, career studies, vocational psychology and related disciplines of management and organisation studies. Furthermore, this study also constituted a response to Hirschi (2017) who was alarmed that the topical discussion of Industry 4.0 did not address the implications of digitisation for career development and the relevant models and frameworks. While this study addressed the gap in literature, it contributes to the advancement of knowledge and development of theory in the fields of vocational psychology and human resource development.

5.5.2 Practical contribution

The practical contributions emanating from the present study provides insights into how the 4IR will impact the HR profession, organisations and the community at large. The findings of the study specify that communication is key to understanding the requirements of the 4IR and thus requires stakeholders to engage each other on the benefits and opportunities thereof. The 4IR requires the need for business to rethink their workplace strategies by implementing HR practices that will prepare the workforce for multiple job changes across occupational boundaries. The findings of this study indicate that the HR profession has transformed from a transactional role and HR practitioners therefore need to be included as strategic partners to business. The findings of this

study further highlighted the importance of skills development and aligning the education system to the needs of business. Government is responsible for policy formulation and thus need to implement policies that create an enabling environment for the benefit of all in the 4IR. To mitigate the risks associated with the perceived job losses due to the 4IR, government needs to collaborate with industry and academia to find a solution. The contribution to practice offers recommendations to study through the perspective of the three distinct actors of the Triple Helix system: business, academia and government.

5.5.3 Recommendations of the study

5.5.3.1 Business

- Organisations need to prepare the workforce by inculcating a culture of continuous learning by reviewing their training and development offerings and applying appropriate systems and practices to support professional development. Employees need to be retrained to perform new tasks and use updated technology.

- Given that some tasks will be automated, HR professionals could implement organisational practices such as job redesign/ rotation and flexi-time work arrangements to allow affected employees an opportunity to acquire appropriate skills to future proof their careers.

- HR professionals need to harness the power of AI technology through the recruitment and selection tools to identify talented employees capable of adapting to the new psychological contract for the 4IR workplace. Employees with personal competencies such as high degree of learnability and cognitive flexibility are required for the 4IR workplace.

5.5.3.2 Academia

- All education authorities need to ensure that the curricula are developed and redesigned based on the nature of skills required to function in the 4IR.

- The skills set presented in this study offer insights to education authorities on the skills the future workforce require, namely: technical competencies, methodological competencies, social competencies and personal competencies.

- In addition to curricula development for the future workforce, skills facilitators will also require training and development to certify they have the requisite skills to train the future workforce.

5.5.3.3 Government

- Government, as policymakers, need to ensure that their policies create a conducive environment for start-ups and established organisations alike to participate in the digital economy. Government, as the custodians of law have a role to assist organisations stimulate the economy through policy and legislation.

- Although technical competencies are being addressed through the introduction of subjects such as robotics and coding skills, the implication for government is that infrastructure needs to be upgraded to accommodate these new requirements. The enabling of spectrum is an example of how legislative intervention will address the digital divide by enabling access to digital technology to everyone.

- Government needs to create an enabling environment for entrepreneurial activity for budding entrepreneurs. The findings of this study also indicated the growth and sustainability of SMEs as being important. Training and development of entrepreneurs through partnerships with relevant stakeholders will aid in understanding the policies required and innovative practices that need to be implemented in the VUCA world of the 4IR.

5.6 Limitations of the study

As with any study, this dissertation was not without limitations. Limitations pertaining to the research design were explored in Section 3.9.4 on transferability. A key feature of a qualitative

research design is that the results cannot be generalised beyond the current research setting (Bryman & Bell, 2011). The intention of the researcher is thus not to generalise from the sample to the population, but rather to describe, explain and interpret the phenomenon (Maxwell, 2013). The sample size for the study comprised eleven research participants and is thus not representative of the population under investigation. Furthermore, the study was geographically limited to organisational leaders in Gauteng province and can therefore not be generalised to other provinces in South Africa. Moreover, the study adopted non-probability sampling method through purposive and snowball sampling strategies which is susceptible to selection and respondent bias. However, the intent of this study was to have a deep understanding of the impact of AI on talent management within the context of the 4IR based on the experiences and perception of the study participants. To this extent, the methodological limitations indicated above did not deduct from the scientific quality and significance of this study.

5.7 Recommendation for future research

Future research on the 4IR could benefit from the participation of a wider population integrating their ideas on workplace innovation. The Quadruple Helix system is an example of how other actors can be integrated to the study. Furthermore, a comparative study of how Sub-Saharan Africa has incorporated innovation in the 4IR, could be of significance to the South African context.

Moreover, the findings of this research identified HR practices such as recruitment and selection, job redesign/ rotation and flexi-time work arrangement as options that could be implemented in preparing the workforce for the 4IR. However, the data collected in this study was from a limited group of HR professionals. Future research could focus on the impact of the HR practices herein outlined by focussing on HR professionals from various organisations. One approach is to focus on organisations that are using artificial intelligence within HR to assess how it is being implemented and organised in practice. Furthermore, there is an opportunity to test theory developed in this study using quantitative research methods. The type of organisation for inclusion in future studies could focus on organisations that have recently retrenched workers due to automation which could offer further insight for industry.

Based on the conclusions from this research study, the researcher recommends that this research be extended to include a more geographically encompassing study. Furthermore, a comprehensive research that utilises a mixed method may be used to achieve triangulation. Triangulation should address the generalisability concerns around qualitative studies. Furthermore, using both qualitative and quantitative research methodologies is recommended to expand our understanding of the 4IR and the effectiveness of the recommended HR practices to prepare the workforce for the anticipated changes. Finally, the research design for this study was cross-sectional in nature and data was thus collected at a single point in time. A longitudinal study is thus recommended for future research as participants are observed at multiple points in time thus allowing for the monitoring of trends over time (Sedgwick, 2014).

5.8 Conclusion

This study sought to evaluate how organisations are preparing their workforce for multiple job changes across occupational boundaries in the emerging 4IR. Moreover, it sought to identify the skill sets that would be required by employees to function effectively in the 4IR. The final objective of this study was to identify the role of government in mitigating the perceived effect of the 4IR on job losses. Evidence from the study suggests that the relevant stakeholders must take responsibility for educating the workforce about the advantages of the 4IR and the availability of job opportunities. Organisations and individuals need to abandon the silo mentality to function in the 4IR. Furthermore, stakeholders have a duty to empower the workforce by creating opportunities for continuous learning and professional development. However, government is responsible for policy formulation, so they need to collaborate with business in implementing progressive policies that will promote economic growth to benefit society.

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Annexure A: Interview guide

1. What is your general perspective on the impact the Fourth Industrial Revolution will have in South Africa?

2. How should organisations prepare the workforce for multiple job changes across occupational boundaries in the emerging Fourth Industrial Revolution?

3. What challenges have you experienced in preparing your workforce for the impact of the Fourth Industrial Revolution?

4. How have you experienced the effect of the 4IR in terms of how you conduct your job?

5. What is your organisation doing to prepare those who are likely to lose their jobs due to the advent of 4ID?

6. What is talent in the era of the 4IR given that the competence required today may not be relevant for tomorrow's job?

7. How will your organisation identify skillset and training needs for 4ID given that some jobs do not yet exist?

8. How will you assist employees find meaning and purpose in their jobs?

9. What skills will be required by employees in order to function effectively in the 4th industrial revolution?

10. Are qualifications still a priority in recruitment and selection for the Fourth Industrial Revolution?

11. What should government do to mitigate the perceived effect of the Fourth Industrial Revolution on job losses?

12. What HR practices, policies and legislation do you feel needs to be in place for the 4IR? (consider relevant stakeholders such organisations, universities, labour unions etc)

Annexure B: Ethics clearance certificate

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Moagi

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H18/11/47**
PROJECT TITLE	Exploratory evaluation of the impact of the fourthe industrial revolution on talent management: A multiple case study approach
INVESTIGATOR(S)	Miss T Moagi
SCHOOL/DEPARTMENT	Economic and Business Sciences/
DATE CONSIDERED	23 November 2018
DECISION OF THE COMMITTEE	Approved
EXPIRY DATE	26 February 2022

DATE 27 February 2019 **CHAIRPERSON** J. Knight
(Professor J Knight)

cc: Supervisor : Professor M Samuel

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to completion of a yearly progress report.**

_____ Signature

_____/_____/_____ Date

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES