THE TERTIARY EDUCATION INSTITUTION OF THE FUTURE TOWARDS 2030: SCENARIOS FOR SKILLS TRANSFORMATION

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Submitted in partial fulfilment of the requirements for the degree of **Master of Business Administration (MBA)** in the Faculty of Business and Economic Sciences in the Graduate School of Business at the Nelson Mandela University

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Degree of Confidentiality: A

December 2018

DECLARATION

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DECLARATION:

In accordance with Rule G5.6.3, I hereby declare that the above-mentioned treatise/ dissertation/ thesis is my own work and that it has not previously been submitted for assessment to another University or for another qualification.

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ACKNOWLEDGEMENTS

My heart felt gratitude goes to all those who directly or indirectly contributed towards the completion of this study. In particular, I would like to acknowledge the following:

- I am eternally grateful to my Lord and Saviour, who made me fight a good fight and finish the race. Without His grace, wisdom and power, I would not have done it.

- To Gabriel and Anna Chikoti, my parents, who have been patient, loving and supportive.

- To the rest of my family and friends, thank you for your words of exhortation.

- To Jon Oxley, a special thanks for your endless support and inspiration.

- To my editor, Sara Thackwray, thank you.

- To my MBA group – Lerato, Fezeka, Grant and Craig – I doff my hat to you people for the encouragement, laughter, strong work ethic and being my second home.

- To my supervisor, Professor Chris Adendorff, thank you for your guidance, demanding excellence and for believing in me. I truly appreciate how your mind opened my mind to a world of possibilities.

ABSTRACT

The research methodology used in this research was comprised of Inayatullah's Six Pillars of Futures Studies, in which emphasis was placed on scenario planning and the creation of alternative scenarios for the tertiary education institutions in South Africa towards 2030. An environmental scan revealed the drivers of change in the education sector and in the world of work. Deepening of the future of education was done through Causal Layered Analysis (CLA) to facilitate the discerning of issues from various viewpoints in the creation and expansion of transformative stories so as to provide a window into possible futures for skills transformation.

The four scenarios for the tertiary education institution of the future, namely "Stairway to Heaven", "Highway to Hell", "Bat out of Hell" and "Still Raining" were developed. These scenarios can be used as departure points by tertiary education providers to make strides towards the Global Sustainable Development Education 2030 targets and the attainment of South Africa's Vision 2030 targets contained in the National Development Plan. Equally important, these scenarios make known what was previously unknown, exploring the possible and impossible, and encouraging new, innovative thinking for decision-makers.

The "Stairway to Heaven" scenario supplies a future in which all stakeholders approve of and embrace the mandate of providing relevant skills and job readiness in a fast-changing world, and the benefits are maximised for all involved through co-creation. It is a scenario where industry, tertiary institutions and society have decided that the purpose of education should be lifelong learning for a viable, productive and sustainable world. The desired future of tertiary education is set against a backdrop of public and private sector collaboration, with the aim of turning the nation into an excellent hub for skills transformation. Furthermore, the scenario provides some insight on the vital measures required to embrace the innovation and the appropriate pedagogy.

This research was motivated by the need to shine a light on the 21st century learner, rapidly obsoleting skills, no-collar worker, skills of the future, learning futures, and possible predictions about what new jobs may come into existence so that educationists can better prepare for the future. This research offers solutions on how institutions can prepare students for future jobs, especially considering the rapid changes in jobs and the unprecedented demise of certain jobs. The research closes a research gap through creating scenarios that offer various

stakeholders in the tertiary education sector different insights and analysis into a number of interpretations of the potential paths that they can follow. The scenario application culminated in the formulation and creation of a "future vision of the tertiary education institution in South Africa towards 2030", delivering a platform for skills transformation that will deliver adaptable workers, and sustainable and inclusive progress for all South Africans.

To bring transformation into the present and design the future that embraces skills transformation, it is invaluable to interrogate the roles and choices that stakeholders of the educational sector make in determining the preferred future. The approach of this research makes it clear that, as the new world of work transpires, policymakers, students, labour, educational leaders, captains of industry and workers must proactively manage the workforce transitions. The focal issue is to discover the appropriate tools that will establish the confidence necessary to create the preferred future for skills transformation in tertiary institutions. This research has laid a platform for co-creation with various stakeholders in an effort to visualise a tertiary institution that contributes to skills development.

The vision must accept that the South African jobs and skills historical profile is different from that of industrialised countries. Alternatively, the nation should respond to the double-barrelled challenge of participating in a high skills' competitive environment on a global scale, as well as a local context that creates low-wage, blue-collar jobs to absorb the large numbers who are unemployed. The challenge is even greater for South Africa, because the economy – if highly service-oriented, with a big informal sector and a quality postgraduate education offering – is supported by a basic education system that is not producing enough critical thinkers who are equipped for university and work life. Thus, the system requires a double transformation to ensure student-centredness and meet the needs of a future worker.

Keywords – 21st century learner, Causal Layered Analysis, Co-creation, Drivers of change Environmental scan, Lifelong learning, National Development Plan, No-collar worker, Scenarios, Six Pillars of Futures Studies, Skills transformation, Workforce transitions.

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CHAPTER 1

THE RESEARCH PROPOSAL

1.1 INTRODUCTION

A grade one learner in 2018 will probably graduate high school as part of the class of 2029. This learner will likely enter the workplace and encounter new roles that do not currently exist. Hence, it is paramount that educators and institutions embrace learning experiences that have links to training, skills and competencies applicable for the workplace (Ahmad, 2015). Provision of quality workers is a massive prerequisite for economic transformation, and the Sub-Saharan region lags behind in the level of education and skills relative to other regions (Boateng, 2015). According to Gidley (2013), the importance of predefined curricula needs to diminish, so as to accentuate an evolutionist educational focus. This should be punctuated with creativity, imagination and dialogue in order to prepare people for a kaleidoscopic and unpredictable environment. The challenges to overcome include: lack of industry involvement, lack of enthusiasm to promote technical and vocational skills, over-production of humanities skills, and a narrow focus on examination instead of practical orientation, case studies and problem solving (Boateng, 2015).

With so many learning entities enslaved by bureaucracy and lack of foresight, educational reform has been glacially slow - not only what is taught, but also how it is taught (Vermeulen, 2017). Transforming teaching and learning is difficult, but digitalisation has resulted in a future classroom that capacitates for living and working in a world of Artificial Intelligence (AI), internet of things and automation (Vermeulen, 2017). In as much as resources have been pumped to modernise educational systems, reformers have yet to grasp that it is not the "system" that needs fixing as much as the education that the system provides. Changing the status quo means implementing a future-oriented curriculum that engages students and equips them with the knowledge and skills for the future (Prensky, 2012; Redecker, 2011; Scott, 2015). The "future-orientation" approach is vital.

The Centre for Curriculum Redesign (CCR) lays down the competencies needed for the 21st century, but also confirms that it is a joint effort between educators, curriculum planners, policymakers and learners (Fadel, Bialik & Trilling, 2015). According to Organisation for

Economic Co-operation and Development [OECD], education or training cannot be correlated directly with the acquisition of the particular skills required by the labour market. Many universities do not give adequate practical preparation for work, but give far too much theoretical preparation instead (OECD, 2011; Cobo, 2013). There is a mismatch in terms of being over-skilled or over-qualified, as well as being under-skilled or under-qualified. Despite increased access to higher education (UNESCO, 2010; Cobo & Moravec, 2011), there is an increasing number of under-employed workers (OECD, 2011).

That less than 33% of people (ages 19 to 29) surveyed in the Generation Europe Foundation study believed that they had been given the required skills, raises questions about the contributions of education, and its preparation for the working world (Generation Europe Foundation, 2010; Cobo, 2013). Finnish future-ready foundational education, which imparts knowledge and skills that have purchase in the modern workplace is the best example of a differentiated higher education system (Habib, 2016). Finland ranks highly in competitiveness and the human development metrics because of the different mandates and responsibilities of each institution. These are independent and yet connected to one another, and thereby able to respond nationally and globally (UNESCO, 2004; Habib, 2016). According to the African Centre for Economic Transformation (ACET) in 2009, Germany had 53.2% enrolment in TVET colleges, Finland had 55.1%, Ethiopia 59.5%, Ghana 13.2%, Kenya 1.0% and South Africa 9.7% (Essel, Agyarko, Sumaila & Yankson, 2014).

The future is best described in terms of volatility, uncertainty, complexity and ambiguity (Fadel et al., 2015). The global risks that will shape global development include: economic risk, societal risk, technological disruption, geopolitics and environmental risk (World Economic Forum [WEF], 2017a). The trends and risks continue to shift in unprecedented ways that are difficult to predict, yet students continue to study the same curriculum (Fadel, 2015). More than half of Africa's population is under the age of 25, and each year between 2015 and 2035 will have half a million more 15-year-olds than the previous year (World Bank, 2015). Failure to tackle educational and skills development of this youthful population could lead to political and social unrest. However, the main incentive for reskilling is enhancing productivity and promoting innovative-driven growth (Boateng, 2015).

With fiscal mismanagement and low political will in the country, it is very likely that South Africa will always be playing catch up in the skills race for the future. Shay (2017) notes the

unpreparedness of school leavers for university by revealing that only 33% of the 2015 matriculants wrote Mathematics, and only 50% of those (129 481) scored above a pass of 30%. Of the total cohort, 25% wrote Physical Science, of whom 59% (113 121) scored 30% or more.

According to the National Development Plan (2030), there were gains: there was a 71% increase in enrolments from 1994 to 2009, with a corresponding increase of student financial aid from R10.3 million in 1994 to R2.7 billion in 2010. Additionally, university research output went up from about 5 500 in 2003 to 9 600 in 2010 (National Planning Commission [NPC], 2015). The White Paper for Post School Education and Training (PSET) vision targets an increase from 650 000 learners in 2013 to 2.5 million learners by 2030 in Technical Vocational Education and Training (TVET) college enrolments, and a million community college enrolments. Further 2030 targets include: an expected increase in the higher education participation rate from 17% (937 000 learners) in 2011 to 25% (1.6 million learners) by 2030; an increase in the proportion of academic staff with PhDs from 34% to 75%; and an increase in PhD graduates from 1420 to 5000 per annum (Department of Higher Education and Training [DHET], 2013).

If institutions are going to be able to prepare workers for the work of the future, the nature of which is as yet uncertain, it is vital that policy-makers and other stakeholders, including academia, collaborate to manage risk (WEF, 2017a). The drivers of change are intertwined in a complex way. For example, because of their beliefs, millennials are changing the way people work but this has also subsequently led to their parents extending their working lives, because millennials are taking longer to leave the nest. Added to that, there are new business models, technological skills shortages, unpredictable political contexts and advances in AI and machine learning (Christidis, Miller, Kelly & Farley, 2017). This research tries to provide answers in terms of how institutions should prepare their students for future jobs.

Over 25% of adults surveyed by the OECD revealed a mismatch between their present skills and their job specification. As if this is not enough, approximately 35% of the skills needed for jobs across industries will be different by 2020 (WEF, 2017b). Automation often results in layoffs, and the down-skilled switchers lose on average 15% of what they earned annually before retrenchment. Employees moving to an upskilled job lose a mere 0.7% of pre-displacement earnings, more than stayers do (Nedelkoska, 2015). Companies, governments and educational institutions need to collaborate to facilitate continuous skilling. Will jobs disappear

in 2050? Will there be more leisure time? The hypothesised trajectory is towards part-time and freelance work as sophisticated machines are fast outpacing jobs (Seager, 2016).

Through futures methodology, this study will attempt to methodically enquire, create and test probable and desirable future visions (Glenn, 1994). Inayatullah (2013) concludes that Futures Studies has evolved in its ability to not only predict and interpret the future, but its capacity to play an important part in creating it. The future visions will assist in the creation of policies and strategies, which will help bring desired and likely future circumstances into closer alignment (Glenn, 1994). Thus, Futures Research is inherently problem-solving, because it seeks to detect the trends that are shaping the future (González, 2013). By gaining greater insight into what decision-makers do not know, but need to know, managers will be able to make informed decisions (Glenn, 1994). The end goal is to propose "possible futures", because the future is not predetermined, but people can influence the future and change it through their actions and decisions (González, 2013).

1.2. RESEARCH PROBLEM

As discussed above, the global risks and rapid changes in the workplace are making it difficult to predict the future of education. Education should prepare students to adapt to the future world of work and empower them to improve on it on an active basis. Alas, the education systems struggle to prepare workers to succeed. As the workplace changes dramatically, education is not adapting at a pace fast enough to meet all the demands these changes are bringing. The educational solutions of the third industrial revolution are still in place in the Fourth Industrial Revolution [FIR] (Fadel, 2015). Organisations are not going to protect jobs, regardless of investment in those jobs. Investing in adaptability and re-skilling will surely protect the people (PwC, 2017).

Most of the radical changes in education have been due to digital technologies. A wide range of new possibilities is evident in schools, universities and executive education and training. According to the Future of Education Report (2015), the ability to select from a wide range of pre-selected online lectures has shifted teachers' roles from merely lecturing to coaching. Ted Talks, Massive Open Online Courses [MOOCs] and tutoring platforms radically change the way education is taking place (Gamper & Nothelfer, 2015). The university of the future may not have a football team or a physical library. The demise of the university campus as predicted

by many is getting closer due to technological advances, as Information and Communication Technologies [ICT] will facilitate future education through a variety of channels and media "*many, if not most, not yet invented or imagined*" (Adendorff, 2014).

South Africa`s main impediment to sustainable job creation is the structural mismatch between labour demand and supply - 15 million of the total labour force are employed and 7.5 million are without jobs. Of the employed population, 20% has a tertiary qualification, 32% has finished secondary education and 48% are devoid of a matric (Reddy et al., 2016). The status quo is worrying, because provision of quality workers is a massive prerequisite for economic transformation (Boateng, 2015). After investigating the link between education, unemployment and crime in South Africa, Gerber and Matthiae (2015) estimated the cost of poor education to be R7 720 430 159 annually. The amount includes education expenses that did not yield proper return on the investment made and a proportion of correctional services costs.

The role of new entrants into the education sector is important, especially for NGOs and private individuals who are sharing their knowledge without pursuing commercial interests. Yet in spite of the changes in higher education, the issue of access for all is still far from being a reality, due to infrastructure and financial limitations (Adendorff, 2015). To overcome problems, the South African higher education providers must respond to such complexity in a proactive, flexible and calculated manner. The leaders need to develop alternative future scenarios to make sense of the highly complex environment (Odhiambo, 2014). It is incumbent upon these institutions to renew themselves and take advantage of the opportunities in different scenarios to make a meaningful contribution to its citizens and the future.

The future is not only complex, but also ever changing. Managers cannot predict the future, but can create a future in which we would all want to live (Inayatullah, 2013; Cobo, 2013). To envision future education, a **macrohistory** is required, without neglecting the new possibilities, spaces and tools that institutions already possess. The solution is to propose "possible futures", because the future is not predetermined, but people can influence the future and change it through their actions and decisions (González, 2013). The probable or desirable can be determined using qualitative and quantitative methods. By scrutinising diverse possibilities, one comes closer to shaping the future, rather than merely predicting it (Adendorff, 2015).

1.2.1 Primary research question

This study will address the primary research objective by investigating the factors influencing the future of the tertiary education sector towards 2030.

1.2.2 Secondary research questions

To support the main research problem, the secondary research questions are tabled below.

Table 1.1: Secondary research questions	
RQ_1	What are the drivers of change in determining the future of education in RSA and globally?
RQ_2	What are the consequences for not embracing the education of the future?
RQ_3	Which role-players should be involved in the determination of future skills?
RQ_4	In what ways might the future of South Africa's tertiary education be transformed?
RQ_5	What approaches could be adopted to envision a preferred future for the South African tertiary education institution?
RQ_6	What are the possible, plausible and preferred futures for South African tertiary education towards 2030?

1.3 RESEARCH OBJECTIVES

1.3.1 Primary research objective

The primary objective of the study is to improve the readiness of South Africa`s tertiary education institutions by gaining an understanding of the drivers of change that will lead to the development of alternative future scenarios. This will include the identification of their desired future leading to 2030. The realisation of the primary objective will be achieved through establishing futures scenarios that institutions can implement for skills transformation.

1.3.2 Secondary research objectives

To support the main research objectives, the secondary research objectives are tabled below.

Table 1.2: Secondary research objectives	
RO_1	To analyse the drivers for change in the global tertiary education trends towards 2030.
RO_2	To conduct an in-depth analysis of education within FIR so as to establish whether FIR is dictating what should be taught and how it should be done.
RO_3	To consider emerging threats and opportunities that will influence the future of South African education by plotting various alternative futures in accordance with specific drivers.
RO_4	To analyse factors that impede the implementation of plausible futures for South African tertiary education institutions.
RO_5	To gain a better understanding of the best possible future for South Africa.
RO_6	To analyse South Africa's progress and failure in terms of skills transformation in institutions of learning.
RO_7	To develop a set of recommendations to meet future skills needs.

1.4 DEFINITION OF CONCEPTS/RESEARCH BOUNDARIES

1.4.1 21st century education

The generation of the 21st century will have at least six different careers, and with that re-educating is a prerequisite (Fisk, 2017). The unforgiving nature of innovation will constantly demand new skills and knowledge to keep pace. It is like shifting sands. Hence, educators will continue to debate content relevance and diverse processes of learning. Alluding to the disruption in education, Clay Christiansen (2011) points to the dramatic unbundling of the incumbent education so that it can be personalised, peer-to-peer and continuous. Fisk (2017) mentions drivers of Education 4.0 as future skills, 100-year life, millennial mind-set, digitalisation, personal data, collaboration platforms and so on.

1.4.2 The Fourth Industrial Revolution (FIR)

The FIR refers to the use of digital technologies to make manufacturing more agile, flexible and responsive to customers (Maltais, 2017). Unlike Industry 3.0, Industry 4.0 is an end-to-end digital ecosystem with value chain partners connected across businesses, cities and countries (PwC, 2016). It is not only changing how things are done and what is done, but as Klaus Schwab (2016) puts it, "technology is changing what it means to be human". The FIR is synonymous with an omnipresent and mobile internet, sensors, AI and machine learning (Schwab, 2016). Global Risks Perception Survey [GRPS] 2017 respondents rate AI and robotics as the emerging technology with potentially the most devastating impact over the coming decade (WEF, 2017a). The FIR is not only ushering in new global risks, but also exacerbating existing risks. Effects are seen in displaced lower-skilled workers, gig economy workers with no employer-sponsored protections and older workers and retirees devoid of pensions. Hence there is a desperate need to develop a comprehensive strategy for new employment patterns, reskilling of workers and tackling longer lifespan challenges (WEF, 2017b).

1.4.3 Workforce of the future

A 'no collar' workforce will be a reality in the near future, where humans and machines will work in a single loop, in a complementary manner. This means that Human Resources activities will be tailored for a hybrid workforce. This is not without its own challenges, as there is need to retrain augmented workers to keep up with the virtual workers, bots and other AI capabilities (Deloitte, 2017). The German's White Paper on Work 4.0 reports a growing consensus that the future work is going to impact the welfare state and social security systems. Work 4.0 does not reflect the 'normal status quo' workplace, but new prospects and opportunities for shaping developments in the future. According to the paper, in a future digitalised Work 4.0, gainful employment will be in the context of a broader pivot in values such as standard employment relationships, individual flexibility in cementing life plans and social protection (Germany Federal Ministry of Labour and Social Affairs, 2017).

1.4.4 Global competency

OECD (2016, p. 4) defines global competence as "the capacity to analyse global and intercultural issues critically and from multiple perspectives, to understand how differences affect perceptions, judgments, and ideas of self and others, and to engage in open, appropriate and effective interactions with others from different backgrounds on the basis of a shared respect for human dignity."

Global competence is a quantifiable learning goal broken down into dimensions and their respective components. These dimensions are knowledge and understanding, skills and attitudes. A globally competent person is primed to solve globally relevant problems and enhance future generation sustainability. Even though social and emotional skills are, at their core, built in early childhood, becoming completely globally competent is not possible (Deardorff, 2014; OECD, 2016).

1.4.5 National Development Plan

The South African National Development Plan (2030) focuses on job creation and sustainable livelihoods, infrastructure development, lowering carbon emissions, improving education, innovation and training, enhancing quality healthcare, transforming society and striving for unity and a capable state. These Vision 2030 targets are pinned on enhancing access to the highest quality of education and training for all (NPC, 2015). South African students' performance in international standardised tests should be contrastable to the performance of other students from nations with similar level of development and access to resources. The graduates should have the skills and knowledge to meet the present and future needs of the economy and society (NPC, 2015; Adendorff, 2015).

1.4.6 Futures Studies

Unlike the past, which has History, and the present, which has Journalism, the future has no evidence to report on (Bishop & Hines, 2012; Morgan, 2015). Futurists cannot prophesy the things that will happen. However, they can come up with a range of probable and preferred futures, and projections about how these futures may come into being (Glenn, 1994). Futures is primarily concerned with the future projections of, and discontinuities in, past trends, as well

as current views of the long-term future. Futurology is interested in the possible, probable and preferred futures, and the worldviews and myths that underlie them (Inayutullah, 2000). Using alternative futures, institutions can act sooner, rather than later, and avoid an unfavourable future scenario (Adendorff, 2015). The aim of futurists is not to know what the future will look like, but to make insightful decisions today (Glenn, 1994).

1.4.7 Scenario planning

A scenario is not a single prediction or forecast, but a way of organising many statements about how the future may unfold. These, in turn, serve as shock absorbers when the real future evolves. Essentially, these scenarios probe areas of uncertainty and describe events and trends as they could unfold (Glenn, 2009; Adendorff, 2014). Scenario planning is a method for scanning and monitoring the highly fluid and complicated environment to test strategies in a broad range of possible situations, which then underpins informed decision-making. Scenario planning furnishes the means for improved strategic decisions and corrective actions when properly executed, connecting the world of 'what-ifs' with practical and realistic decision-making (Adendorff, 2014). This insulates organisations from worst consequences and capitalising on opportunities.

1.4.8 Causal Layered Analysis

Inayatullah developed Causal Layered Analysis (CLA) as a method that goes deeper than the obvious and surface issues by unearthing underpinning systems, structures and worldviews. By going beyond the cosmetic outlining of feelings and reactions, CLA investigates the often unconscious and unarticulated views and perspectives behind an issue. There is a holistic view of the issue within the broader social structures within which it is experienced, together with identifying associated meanings. Accepting diverse and often dissimilar perspectives means that the delineation of the issue is not according to reality, but largely according to perceptions and myth (Inayatullah, 2004; Conway, 2012). The aim of CLA is not to foresee a particular future, but to enable the articulation of constitutive discourses, possibly for scenarios creation (Inayatullah, 2004).

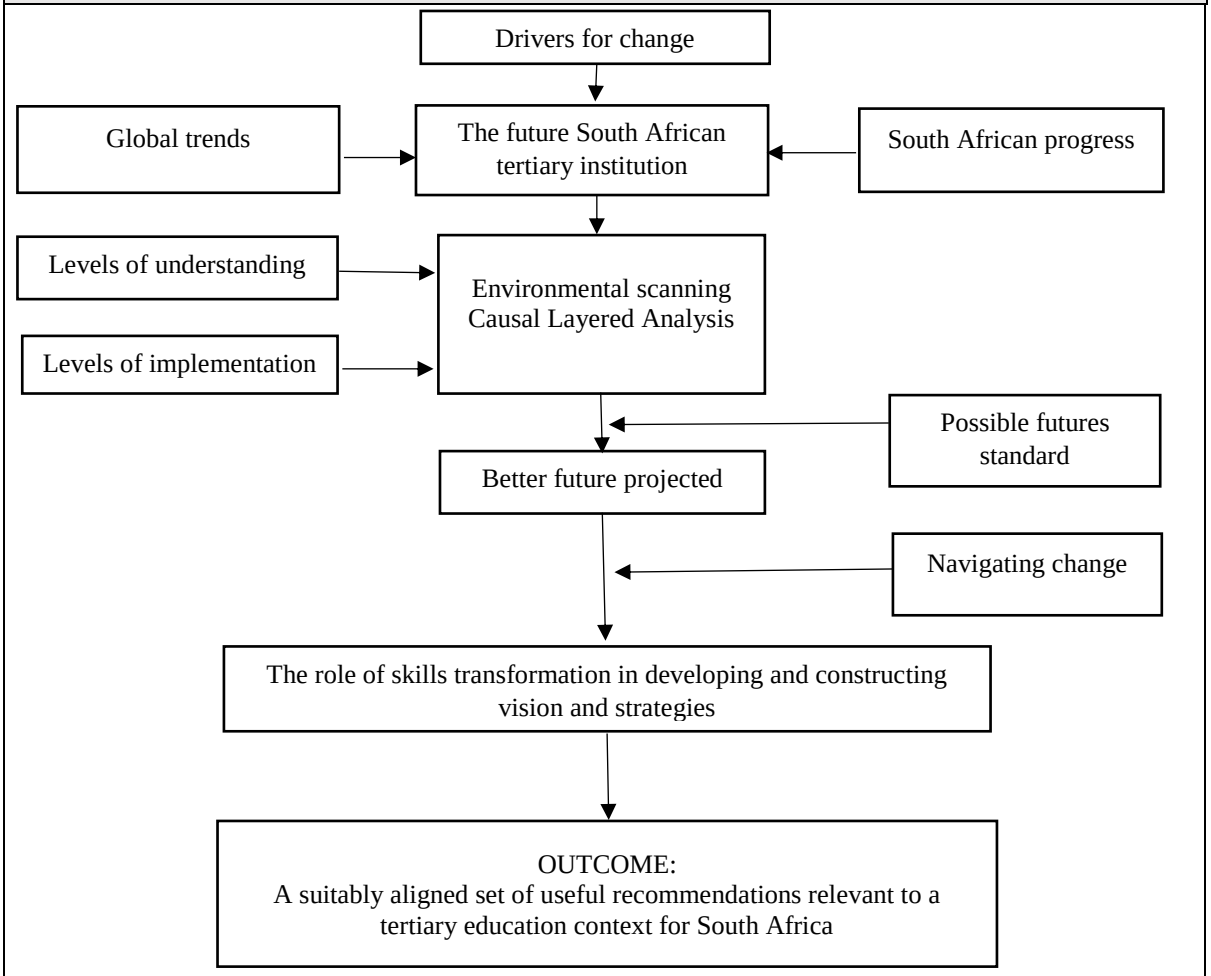
1.4.9 Complexity and living systems theories

Complexity theory suggests that the future is patterned and chaotic. In other words, it can explained, but not accurately predicted. Understanding this 'both/and' view is crucial in reconciling the agency chasm (for example, that individuals can influence the future and structure; structures define individuals and limit what is possible). The complexity/chaos theory also postulates that different states can emerge from less complex states and that as many variables as possible should be considered (Inayatullah, 2004). Awareness and knowledge of tools are not enough to understand interactions between complex organisational systems and environmental dynamics. Enabling leadership is important, too (Nel, 2015), as this signals proactive, rather than reactive, decision-making. Linear planning relies on historical trends, the status quo and a static view of the future. Complexity perspective, on the other hand, embraces acausal, non-linear interpretations of systems (Nel, 2015). A strategic plan itself is not a blueprint for a future desired state, but prepares an organisation to be more mindful of, and responsive to, the constant changes and possibilities emerging from its environment (Prewitt, Weil & McClure, 2012).

1.5 CONCEPTUAL RESEARCH FRAMEWORK

A conceptual framework has been developed below to better understand the purpose of this study. The conceptual design describes the extent to which the global trends influencing education are understood, in terms of the 21st century education, FIR, Internet of Everything (IoE) and the workforce of the future. It also aims to identify transforming drivers and progress made in South Africa. The **Six Pillars of Future Studies** methodology will be used to turn the level of understanding into future-ready ideas, which South Africans can implement.

Figure 1.1: Conceptual framework



Source: Researcher's own construction

1.6 THE IMPORTANCE AND BENEFITS OF THE STUDY

The initial review of the literature identified that there is limited information about what we should expect and what we should be uncertain about regarding the future of tertiary education institutions. The providers of education in the West seem to be on a different wavelength from those in South Africa as far as future education is concerned, and it paves the way to investigate what is applicable to the South African context. Many studies have focused on the role of curriculum or technology in determining the future of education, but there is a dearth of possible, plausible or preferred future outcomes for South African tertiary institutions. There is a need to shine a light on the 21st century learner, "Age of the Obsolete", 'no collar' worker, as well as skills of the future and learning futures, so as to possibly predict new jobs that may

come into existence. All this so that educators can better prepare for the future. All these factors point to complexity and volatility, thus making the case for research into Futures Studies concerning tertiary education.

Researching 2030 futures for tertiary education will result in a number of benefits:

- The contribution the study will make to advance this particular body of knowledge, especially given the scarcity of research into the role of tertiary education for skills transformation.
- Futures Studies as the study of change will better prepare countries to make strides towards the 2030 global targets concerning Sustainable Development in education.
- Futures thinking and scenario planning as tools for anticipating and proactively responding to challenges and opportunities that could influence the attainment of preferred futures.
- The need for in-depth research into the drivers of change that will affect the attainment of South Africa's Vision 2030 targets contained in the National Development Plan.
- The usefulness of scenarios in thinking through the possible/plausible/preferred futures of South Africa's tertiary education, and the key variables that will shape these futures.
- Investigating new tertiary educational products and services that could be introduced in the future for the 21st century worker.

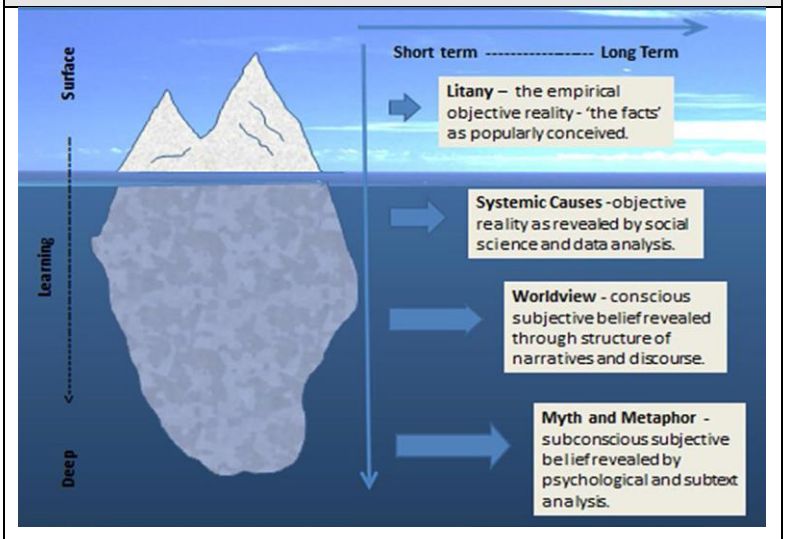
1.7 RESEARCH DESIGN AND METHODOLOGY

The study is located within the **mixed methods** paradigm, which incorporates philosophical assumptions and theoretical frameworks. By marrying qualitative and quantitative approaches, mixed methods can be seen as the best of both worlds. This is because it eliminates the disadvantages of either method and supplies a more concrete understanding of a research problem than either methodology alone (Creswell, 2014). Interpretivism research tradition is concerned with idealism (meaning) and uses qualitative research as a data collection methodology (Collis & Hussey, 2014). Quantitative research is concerned with examining the relationship among variables to test objective theories (Creswell, 2014). Positivism is based on the statistical analysis of quantitative data and arranges the knowledge with the assistance of quantification to improve precision in the narrative of parameters and the connections between them (Thomas, 2010; Collis & Hussey, 2014).

The study will follow Inayatullah's **six pillars** of Futures Studies approach, which furnishes a theory of futures thinking that is associated with methods and tools that are matured through practice (Inayatullah, 2008). The pillars can be used as theory or in a futures workshop context. The six pillars are: mapping, anticipation, timing, deepening, creating alternatives and transforming (Inayatullah, 2008). An **environmental scan** (mapping) of the drivers of change and their impact on tertiary education will be performed to uncover the existing trends and driving forces influencing the future of the industry. Casual Layered Analysis (**CLA**) will be the primary futures methodology for investigating deeper causal issues for the purpose of formulating scenarios. Primarily, CLA takes the form of a quantitative data analysis technique that adopts a qualitative approach to gathering and analysing data (Inayutullah, 2008).

CLA uses a structured exploration of four layers of causation to facilitate a deeper critical inquiry (Inayatullah, 2008; Haigh, 2016). Thus, it transcends the superficiality of conventional forecasting. The theory of CLA posits that there are various layers of reality and ways of knowing. This supposes that, beneath the popular conceptions of an issue (the litany) and the more academic analysis of systemic causes, are deep worldview commitments, discourses, myths and metaphors (see Figure 1.2). Moving along these levels leads to better comprehension of the issue so that alternative futures can be investigated and desired futures created (Riedy, 2008; Inayatullah 2009; Conway, 2012).

Figure 1.2: Causal Layered Analysis levels



Source: Haigh (2016)

An inductive approach will enable exploration of the pertinent literature in this research endeavour. Inductive reasoning starts with observations and focuses on understanding dynamics, robustness, emergence and the construction of alternative futures. Exploratory studies make it possible to have a full appreciation of the research objectives and questions, thus asking the right questions and gaining new insights into the enquiry under study. Through the inductive approach, the researcher attempts to provide alternative explanations to what is really happening, including:

- Identifying and grasping key global driving forces;
- Selecting key factors relevant to the context of South African tertiary education;
- Selecting plausible storylines and giving memorable names to scenarios;
- Identifying the likely impact of various scenarios for the tertiary education sector;
- Testing the policies against the scenarios;
- Spotting leading indicators and change-navigation factors, so as to establish a contextually aligned set of practical and transformational recommendations.

In as much as there is a difference between normative forecasting and exploratory forecasting, a number of techniques apply to both. With its roots in norms or values, normative forecasting addresses the future we want (what do we want to become?). On the contrary, exploratory forecasting examines what is possible, regardless of what is desirable. However, this futures methodology division is not mutually exclusive, as the futurists' "tools" are often quite flexible and adaptable to specific purposes (Gordon, 1994).

As a forecasting method, scenarios tap into the power of storytelling and paint a picture of future conditions. Scenarios are two-thronged: a "future history" shows a storyline of future development from now (present) to some date in the future. A "day in the life" reveals what the world will be like at a certain date. However, scenarios may or not look back on the journey to explain how it got there (Glenn & Gordon, 2009).

1.8 STUDY OUTLINE

Chapter 1 has included an introduction to the research, the research problem and the demarcation of the study. It has highlighted the challenges faced by South African tertiary education institutions, and mentions research objectives and questions. The importance of the study and the important concepts are defined as well.

Chapter 2 will detail research methodologies that the researcher will follow. Using Environmental Scanning ensures the richness of the research outcome by taking advantage of both quantitative and qualitative data gathering. Issues of reliability, validity and ethical considerations will also be discussed.

Chapter 3 will outline and discuss the future of education, work and skills, as well as global competency, global trends and scenarios affecting global and South African tertiary education.

Chapter 4 will discuss the application of the futures methodologies of the Causal Layered Analysis used in this research effort. The use of CLA and scenario planning will give deep insight into the future, and reveal alternative, plausible and preferred futures for skills transformation.

Chapter 5 will offer a preferred future for tertiary education institutions of South Africa within the context of skills transformation towards 2030. This chapter will provide an overview of the research undertaken, summary of the findings, contextually aligned practical recommendations, concluding statements, as well as the research limitations.

CHAPTER 2

RESEARCH METHODOLOGY

2.1 INTRODUCTION

In the first chapter, the research study introduction was formulated. It provided the demarcation of the study and introduced the research problem that guided the research. This included research objectives and questions used by the researcher to provide alternative explanations to what is really happening in the tertiary education sector. Additionally, Chapter 1 introduced the proposed research methodology and design developed primarily for the study of the future that will guarantee a robust and informed research outcome.

The first part of Chapter 2 will discuss an overview of Futures Studies theory and apply the research methodology approach to interrogate the research questions. Chapter 2 provides the scope for decision-making in the tertiary sector, as well as a cosmetic examination of the drivers for change and global trends in education and the world of work. Lastly, this chapter will discuss Futures Studies values and ethics together with the issues of reliability and methodological rigour.

2.2 ORIENTATION AND SCOPING

2.2.1 Tertiary education and the world of work

The rapidness and fluidity of globalisation, demographic trends, technological change and innovation are transforming what kind of work is done, which employee executes it and where and how it is done. These changes are influencing many traditional jobs and labour relations, while birthing new job opportunities in emerging economies (OECD, 2016b). According to Adendorff (2013), South Africa needs to position itself in this mercurial, multiplex and global environment by applying scenario-based planning and, if possible, alter navigation in some form or other. Some experts see the future of work as the survival of the most adaptable, where a person will have to balance three or so different roles at a time (Seager, 2016). Smart factories, robots, virtual reality, haptics and 5G means that education must produce workers who do what computers cannot (Hamacher, 2017). Therefore, education presents an invaluable

tool for survival, but the competencies to meet these challenges are vaguely present or missing in the tertiary education curriculum (Fadel, 2015).

The scale and pace of change is rapid due to advances in artificial intelligence and machine learning, both of which are making it difficult for firms to source skilled workers in a context of aging population, disruptive innovations, radical thinking, new business models and political unpredictability (Christidis et al., 2017; PwC, 2017). The OECD's Education 2030 initiative is at the forefront of discerning future knowledge, aptitudes, attitudes and values that current learners will need to learn. It makes use of a combination of theoretical research and foresight methodology that takes into account the opportunities and challenges students will face in a volatile world (OECD, 2017). Skills need to be at the forefront of tertiary education if South African is ever going to build effective skills systems at local and national levels. Skills can be built through more effective vocational education, training and higher education. Tertiary education, as a standard, is one of the best metrics of global competitiveness (Schwab, 2013).

2.2.2 Decision-making in the tertiary education sector

Universities and colleges dominate tertiary education, but new players are entering this arena. This diversification, which is likely to continue, coupled with the entry of the knowledge economy, calls for urgent strategic thinking and actions at tertiary education organisations (Havas, 2009). In response to the knowledge economy and globalisation, hosts of nations have tried to boost international competitiveness by designing macro policies for improving higher education, especially universities (Ritzen, 2006). Against this backdrop, many researchers have tried to propose various perspectives for envisioning future universities, using various futures studies methods (Beynaghi, 2016), such as trend analysis (Boer et al., 2002), CLA (Inayatullah & Milojevic, 2014), delphi study (Hayes, 2007) and scenario development (Inayatullah, 2012; Job & Sriraman, 2013).

Every decision is about the future, every policy and plan is predicated on suppositions about the future, but the vast majority of students (even leaders) in educational systems are never taught how to think critically about it (Bishop & Hines 2012; Lum 2016; Bengston, 2017). Alarmingly, only a handful of universities have ushered formal futures thinking towards strategic thinking, operational planning and risk management. Alas, many continue to deal with uncertainty and complexity using a concoction of random tools and techniques (eclectically

sourced from the field of corporate management theory) that fabricate a veritable chimera of visions, long-term and short-term goals (Finn, Ratcliffe & Sirr, 2007).

By engaging futures strategies now, the tertiary educations institutions can play the long game and make sure that they do not focus on the decisions they will make in the future, but the futurity of their decisions today (Finn et al., 2007). Tertiary education institutions will influence future skills through their choices and actions in the present. Shaping alternative futures starts by establishing a number of scenarios. Inherently, scenario-planning has many stages, including the study of trends. A trend winds into the long term, affecting many societal groups, and appears to have a profound basis. A fad operates in the short term, affecting certain people groups in only a cosmetic way (University Futures, 2007).

Managing 21st century South Africa's tertiary institutions should see universities being corporatised (adopting corporate sector practices and accountability mechanisms) if South Africa is going to meet its needs and compete globally (Habib, 2016). In a world of increasing global and social complexity, today's education will resurrect from its antique status when it starts to equip people with the armour needed to cope with continual adaptation (Gidley, 2013). Skills, especially those that enable adaptation, are vital for achieving sustainable, innovation-driven economic growth and social inclusion (OECD, 2017). The South African government, businesses and NGOs need to partner with tertiary education entities to enable the provision of relevant skills, including: apprenticeship; on-the-job training to smooth the upgrading and adaptation of skills; and the adoption of types of work organisation that take advantage of existing skills (OECD, 2016b).

Seager (2016) warns never to underestimate the role of ongoing education, since the notion of having a 'job for life' will be a farce. "For students, it's not just about acquiring knowledge, but about how to learn. For the rest of us, we should remember that intellectual complacency is not our friend and that learning – not just new things but new ways of thinking – is a life-long endeavour" (PwC, 2017, p. 4). The call to adapt is not only a call to students, but also to tertiary institutions. The answer to this call for tertiary education institutions to revolutionise the way they do business lies in disruptive innovation. Online learning is a disruptive technology that is making colleges and universities reappraise their higher education models (Christensen & Eyring, 2011). All these decisions, whether originating within or forced from the outside, present opportunities to stay relevant and to take advantage of the innovation.

Policy-makers need to understand the reality that the way people are innovating is changing, as well as what this implies for education and training policies (OECD, 2017).

2.2.3 History and future ahead

"*The longer you can look back, the farther you can look forward."* – Winston Churchill (1944)

History is taught at all levels of education, mainly because it helps people understand the forces that have shaped the past and present. However, only a few have attended a course in Futures Studies or strategic foresight (Bengston, 2017). That does not mean that historical figures have not been thinking about the future. If anything, the advert of future thinking can be traced from philosophers and intellectuals like Plato, Thomas More, Heraclitus, Francis Bacon, Augustine, among many others (Irmak, 2003). Philosophers have always marvelled at the link between history and the future, as some early Greeks believed that the future was sometimes so surprising simply in that we face the past, which is clear now, until it, too, fades into oblivion. However, the future 'suddenly' appears in our view from behind us, revealing the notion that 'the future lies behind' (Dator, 1998). One school of thought posits that History (and Anthropology) and Futures Studies should be combined into one discipline called, perhaps, Chronology. Chronology, were it so called, would encompass the study of human ideas about time, and beliefs and interpretations concerning the evidence of the movement of humans through time – from the time the first human communities surfaced through to the end of time. Regardless, it would be foolhardy to presume that Futures Studies is inimical to, uninterested in, or ignorant of, "history" (Dator, 1998). Staley puts it well: *"Historians do not really study the past, but rather evidence from the past that has survived to the present...Similarly, futurists cannot study the future directly — how do you study something that does not currently exist? [A] futurist…must…examine evidence found in the present about the future"* (2007, p. 14).

The first systematic philosophical treatment of the role of the "image of the future" in various cultures throughout human history was carried out by Polak (1971). Polak held that "ideas", specifically ideas about the future, are the main propellants of history that push humankind into the realm of the "other" (Morgan, 2002). The images of the future in the ancient and medieval worlds of the Greeks and Judaists are not convincing. If anything, one must question whether the Greek and Judaic images of the future can properly be referred to as futures images at all. Judaism strongly believed that the future was not shaped by men, but could be realised through

God`s intervention alone. Therefore, ancient images of the future based on Greek mythology and Judeo-Christian eschatology seem forced, and the image of the future is, in fact, a Renaissance-born, modern phenomenon (Morgan, 2002). In the pre-modern era, astrology was the main method used to understand the future; it functioned as an early warning system to help people avoid dangerous predicaments. An unequivocal belief in the astrological system was paramount, since warnings and forecasts, as well as psychological analysis, were of a general nature (Inayatullah, 2013). Most of the fundamental images of the future in modern times have been shaped primarily by Sci-Fi movies (Dator, 1998). Besides science fiction, the other key modern-day thread of futuristic thinking is Futures Studies. Although lacking the entertaining side of science fiction, Futures Studies is usually non-fictional and non-narrative in its approach and format (Serradelpino, 2007).

The Scandinavians were the first to theorise pertinent questions about the future within the framework of economic consultation, science and politics in an effort to influence the macro environmental elements in various ways (Kreibich et al., 2012). According to Irmak (2003), humanity's certainty in creating metaphors of the future in contemporary times is nothing new, as the origins of today's Futures Studies were shaped by numerous philosophers and thinkers a long time ago. In recent times, the uptick in Futures Studies has been precipitated by governments' desire to find information that can aid in making better policy (Inayatullah, 2013).

2.3 FUTURES STUDIES

2.3.1 What is in the name?

Futurists are still to agree on the name or definition of their activity. Futures research is used when systematically identifying alternative futures, along with policy implications and the consequences of policy options for decision-makers. While some like the term 'Futures Studies' – an exploration of what might happen and what we might want to become – others prefer 'Prospective Studies' – the study of the future to develop a strategic attitude of the mind with a long-range view of creating a desirable future (Glenn, 2009). Many futurists often avoid the term, 'futurism', which aims to achieve (or avoid) one particular kind of future. The desired future is known from the onset – for example, a green, sustainable future, or eradicating combustion cars, or mining the moon, or libertarian anarchy etc. (Dator, 1998). Futures

Studies, conversely, does not seek to further any particular view of the future. Rather, it looks to further participative inquiry (broadly or otherwise) into the future by understanding the roots and consequences of each of the manifold images of the future that exist in people's minds, and in support of people's actions (Dator, 1998).

Futurologists were very popular in the 1960s, 70s and 80s, and were seen as the future-thinking counterparts of historical sociologists (Flechtheim, 1966; Cartwright, 2015). People in Futures Studies detest the term, 'futurology', because of the possible connotation of astrology, thus rendering it a pseudo-science (Sardar, 2010; Cartwright, 2015). 'Futurist' is a term that is accepted, though it retains certainty and predictability connotations, which are unhelpful. Nevertheless, 'futurist' is less esoteric and academic than many equivalent terms (Dawson, 2015; Conway, 2015). Other future experts call themselves strategic 'foresight consultants and researchers' rather than futurists. 'Foresight consultant' may be appropriate for individual or small group contexts, where the consultant acts as a guide and mentor. 'Futurist', on the other hand, fits with large-scale international audiences (Conway, 2015, Cartwright, 2015). A name like 'foresighter' suggests "foreseeing something that is not too far and can be actually pinned down" (Sardar, 2010); this creates an illusion. Unlike 'futures', which can evoke open possibilities, 'foresight' does not have a plural, resulting in name derivatives with a singular focus (Cartwright, 2015).

2.3.2 What is Futures Studies?

Inayatullah (2005) defines Futures Studies as a systematic study of possible, probable and preferred futures, and the worldviews and myths that underlie them. Futures Studies is not *monolithic, but layered, and different "layers" reveal different phenomena* (Slaughter, 1999). Future Studies does not precisely predict what will happen to a person, firm or country before it actually happens. Futures experts do not believe in prediction, though some believe they have theoretical understandings and rigorous methodologies, which embolden them to forecast strong tendencies with considerable confidence (Dator, 1998). "The pretension that exploration of the future is, or can be, an exact field of inquiry is both naïve and dangerous" (Sardar, 2010). Futurists have long abandoned predicting the future and are now applying methods that take into consideration multiple ways of knowing, manifold values and deeper worldview commitments (Riedy, 2008). Respected authors believe in the reality of "alternative futures" and not (one) '*the* future'. As a result, Futures Studies is based on the premise of forecasting a

far-ranging variety of possible futures, instead of predicting the future (Dator, 1998). Futures Studies does not produce totally accurate or complete descriptions of the future, but aims to reveal what is possible, cast light on policy alternatives, identify and assess alternative actions, and, at least to some degree, steer clear of dangers and understand the opportunities of the future (Glenn, 2009).

2.3.3 The purpose of Futures Studies

The aim of Futures Studies is to methodically investigate, construct and measure both possible and desirable futures to aid decision-making (Roux, 2010). Futures research is not simply projections of economic and technological nature or socio-analytics, but a multi-disciplinary investigation of change in all major areas of life to unearth communicating dynamics that are crafting the next age (Glenn, 2009). Futures Studies seeks to help students, managers and leaders of communities and nations invent, in order to move effectively towards their "preferred future". At the same time, it concerns itself with monitoring their march towards it, and recalibrating their preference when new information and experience are gained over time (Dator, 1998).

Humanity cannot have dominion over the future, but it can influence where the human race will end up. This influence makes worthwhile the endeavour to consider the balance between the possible and the preferable (Glenn, 2009). Carrying out futures research will not result in a future that is totally determinable, but diverse futures are conceivable, and these possible futures are actually not haphazard (Kreibich et al., 2012). Futures research facilitates the creation of possible futures by making elementary assumptions problematic. Through probing the future, emerging issues analysis, and scenarios, the intention is to motion out of the present and create the possibility for new futures (Inayatullah, 2013). Kreibich et al. (2012) assert that the role of Futures Studies is aimed at clarifying:

- multi-layered, dynamic processes and systems;
- significant and/or global relationships and effects;
- medium- and long-term time frames, viewpoints and potential measures in the future;
- medium- and long-term effects of decisions and actions from the past and the present;
- interconnected discontinuities, uncertainties and outcomes of higher orders;
- sector-spanning issues, problems and strategies; and

- notions about future growths and the effect on current and future behaviour (Kreibich et al., 2012).

2.3.4 Principles of Futures Studies

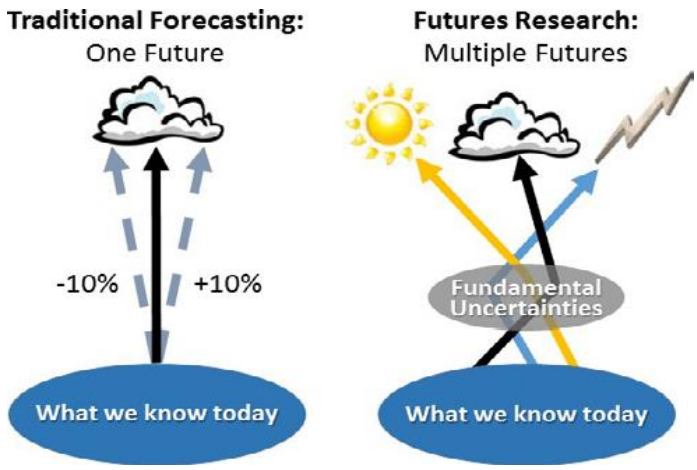
For more than half a century, futurists and scholars in other disciplines have been thinking deeply and creatively about the nature of the future. They have developed many insights about change that shapes the future, and created practical strategies and methods for developing useful foresight (Bengston, 2017). These principles include:

- The future is plural.
- The future is possible, plausible, probable and preferable.
- The future is mostly open, rather than fixed, and our choices and actions are influential.
- Foresight is invariably imperfect and gravely limited.
- The future is surprising and unsurprising, composed of both continuity and change.
- The future is fast and slow. Do not miss the slow by focusing only on rapid change.
- Four archetypal images of the future are present.
- Change that shapes the future can be inbound or outbound. (Bengston, 2017)

2.3.4.1 The future is plural

The basic premise of Futures Studies is the plurality (not singularity) of the future (see Figure 2.1). It is therefore paramount to see the future as *futures* (countless possible alternatives), not future (Dator, 2002; de Jouvenel, 1967; Masini, 1993). According to Bishop (1998), seeing the future as plural is superior for comprehending and planning for the long-term future, because single, clear predictions give a false sense of certainty. After all, the aim futures research is to assist decision-makers prepare for a range of plausible futures, rather than the impossible task of making accurate long-term predictions (Bengston, 2017). Futures research should be judged by its ability to help decision-makers make policy now, rather than whether a forecast was right or wrong (Glen, 2009).

Figure 2.1: One future traditional forecasting compared to futures research



Source: Adapted from Weeks et al. (2011)

2.3.4.2 The future is possible, plausible, probable, and preferable

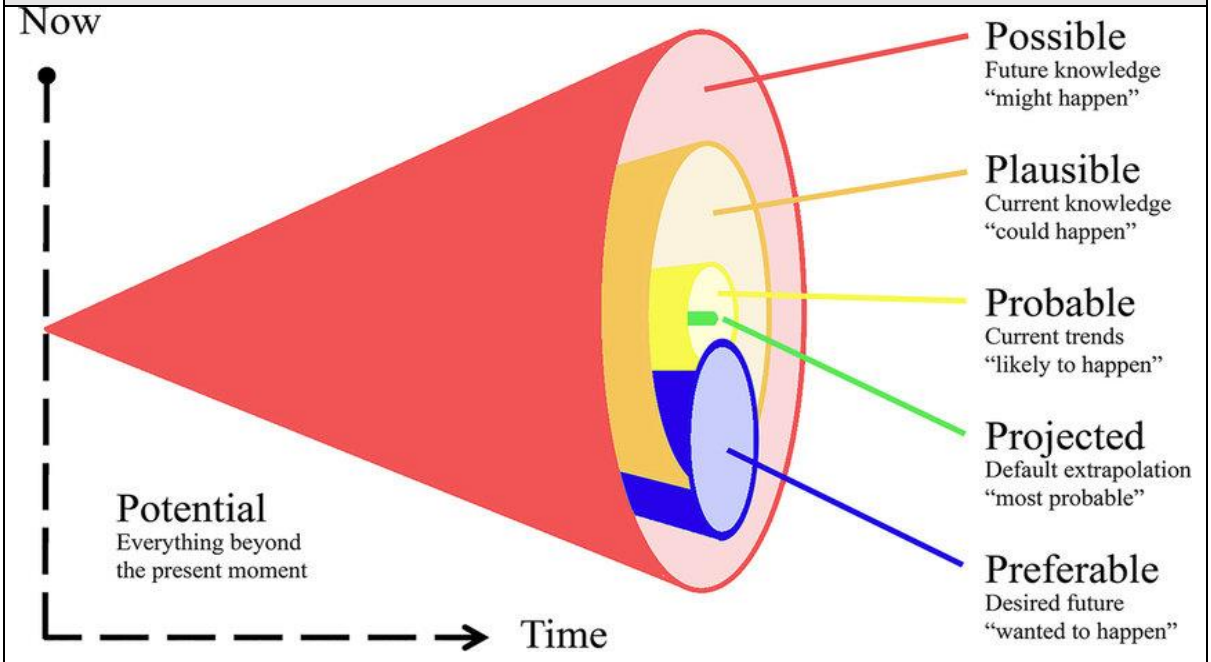
Table 2.1: Types of futures categories forecasted/imagined

Possible	Imagined	Might happen	Irrespective of the laws of the universe
Plausible	Forecast	Could happen	More realistic, structural considerations
Probable	Forecast	Likely to happen	Given historical trends and quantitative data
Preferred	Imagined + forecast	We want to happen	What participants desire, the vision of the community/organisation

Source: Adapted from Gould (2015) & Inayatullah (2008)

The four alternative futures shown in Table 2.1 above are separate, yet interrelated (Hines & Bishop, 2006; Masini, 1993b.). Possible futures signify a full range of alternatives (Gould, 2015) and are incomparably massive and broad because the realm of possibilities is huge (see Figure 2.2). This futures category is rare, because it may involve technology that does not exist at the present moment or events of extremely low probability (Bengston, 2017). "Wild cards" are a type of possible future characterised by low probability, but high impact (Petersen, 1997). Examples of possible wild cards are: abrupt climate change; long-term disruption of internet and communications; and acceleration of nanotechnology (Riley 2012; Lenton et al., 2008; Drexler, 2013).

Figure 2.2: Voros' futures cone



Source: Adapted from Voros (2003)

Although the plausible futures category is still large, it is a minuscule subdivision of possible futures and is seen as a discernible pathway from the present to the future (Hines & Bishop, 2006). They are believable and do not depart from our current understanding of science, technology and social and economic systems. Probable futures are most likely, based on current trends and strategies, and is usually referred to as the business-as-usual or "official" future. Extrapolation of past data for future purposes should be treated with caution as "the most likely future isn't" (Kahn, 1982), given the complex nature of social-ecological systems and the rate of discontinuous change and surprise (Bengston, 2017). Finally, preferable futures are characterised by desired imagination and pragmatism (Inayatullah, 2008; Gould, 2015) to construct what individuals and groups want in the future through a visioning or preferred futuring process. They are bluntly subjective and value judgements-based (Bengston, 2017).

2.3.4.3 The future is open

The assertion that future is open precludes it being fixed and, as a result, there are opportunities and freedom to influence the future in a positive direction (Bishop, 1998; Dator, 2002; de Jouvenal, 1967; Slaughter, 1993). The future is mostly open – at least in the confines of the realm of possibility as governed by physical, biological and social constraints – and our choices

and actions can help create it. Additionally, the future is open in terms of being democratic, translucent, participatory and brimming with many viable choices (Cascio, 2015).

2.3.4.4 The future is surprising and unsurprising

Imperfect knowledge results in a surprising future, but it could also be a result of underestimating uncertainty and the possibility of infrequent events (Saffo, 2007). It could even be a result of expected futures arriving in unexpected ways and with surprising consequences. Futurists propose that the most shocking future would be one devoid of any surprises (Cornish, 2004). This does not mean that the landscape will be unrecognisable in 20 years' time. In fact, in many ways, the future will be similar to today. Saffo (2007, p. 130) supports this argument by stating that, "Even in periods of dramatic, rapid transformation, there are vastly more elements that do not change than new things that emerge." The future contains continuity and change, stasis and fluidity (Bishop, 2012; Lombardo, 2006; Millet, 2011; Naisbitt, 2006; Staley, 2007). Therefore, the insatiable desire to see drastic, sweeping and surprising change springing up everywhere is a major encumbrance for futurists and forecasters, since some things have remained untransformed over history (Bengston, 2017). Carrying out a historical review of futures projects reminds us of important past changes, and that "not every expected transformation actually came to pass" (Lum, 2016, p. 9).

2.3.4.5 The future is archetypal

The future cannot be studied, because it does not exist, but what futurists *can* study are the people's images of the future (Bell, 1997). This is because these images assist in moulding actions today and have a huge impact on the future that will be created (Ostrom et al., 2002; Polak, 1973). Futures Studies tries to understand how people's different images of the future lead to specific actions – or inactions – in the present, and whether certain aspects of the future are created or inhabited due to present actions or inactions (Dator, 1998). Many scenario analyses have used some variation of archetypal approaches, such as developing scenarios for a variety of optimistic, pessimistic, present trends extended or wild card futures (Curry, 2012). The images of the future fall into four generic futures: continue, collapse, discipline and transformation (Dator, 2009). These four archetypal futures are fundamentally different and can be explained as follows:

- Continuation (usually "continued economic growth").
- Collapse ([usually one] environmental overload and/or resource depletion, economic instability, moral decline, outer or inside military attack and meteor impact).
- Disciplined Society (structured around some set of overarching values and usually considered primitive, orthodox, natural, ideologically correct or God-given).
- Transformational Society (usually a "high tech" or a "high spirit" variety, resulting in the disappearance of current forms and the emergence of new forms of beliefs, behaviour, organisation and, possibly, intelligent lifeforms). (Dator, 1979; Dator, 1998).

2.4 FOUNDATIONS OF FUTURES STUDIES

The use of the word, 'future', implies the extrapolation of ideas and images to make sense of the assumptions about tomorrow, or what may or will become the future for a given context. According to Inayatullah (2008), these thoughts and images can be categorised under a spectrum of foundational futures thinking concepts (see Table 2.2).

Table 2.2: Foundational futures concepts	
Default future	Challenging the official business-as-usual future
Used or borrowed future	Why we do not innovate
Disowned future	Why things fall apart and bite back
Alternative futures	Creating adaptability
Alignment	Linking the inner story to the preferred future
Models of social change	Where can we best affect change within the structures?
Uses of the future	Strengthening our confidence to frame futures that we desire
Source: Adapted from Inayatullah (2008)	

2.4.1 Default futures

The futures thinking assumptions are not interrogated, as this type of future is regarded as the right future. The default future is the official (normalised) future, and can often be found as the strategic vision statement within a strategic planning document. The messaging around a default future is often as an opinion, and does not necessarily seek input or feedback (Inayatullah, 2008).

2.4.2 Used/borrowed futures

Have South African tertiary education institutions and stakeholders purchased a used future for their vision of the future by borrowing it from somewhere? On the other hand, is it a future influenced by traditional approaches elsewhere? A future purchased or borrowed from others usually takes the form of ideas and images that have been adopted – either consciously or unwittingly (Inayatullah, 2008). The concept of a used future refers to people being "busy designing for a future, based on the assumption that our world would essentially stay the same" (Matheson, 2008, p. 262). A used future is only important for identifying outdated stories, because used futures are based on (outdated) assumptions that have been greatly challenged by technological, environmental, economic and socio-cultural change. As a result, used future strategies, with passing time, become spirally unproductive, hurtful to the individual and stifle change in organisations. The challenge is to integrate our disowned selves (Milojevic & Inayatullah, 2015).

2.4.3 Disowned futures

Is the aim of decision makers in the tertiary education sector and governments to focus more on short-term gains and strategic plans, inevitably ignoring the development and business models offered elsewhere? The disowned futures are denied and rejected. Usually those futures are brushed aside within ourselves, or they can constitute the views of others, cultures and viewpoints apart from a superior and generally accepted version of the future. "Our excellence in one future can also be our greatest weakness/flaw in another future…For example, we become overly busy on implementing our strategic plan, but fail to see the emerging issues that disrupt who we are and catch us unaware" (Inayatullah, 2008, p. 5).

2.4.4 Alternative futures

Alternative futures is a concept relating to a full range of possibilities in the tertiary education sector to improve skills production, which will improve people's preparedness for the future of work. Alternative futures generally concerns forging flexibility through scenarios to avail a range of choices and potentialities of different futures. By focusing on a range of choices, we can better prepare for uncertainty or embrace uncertainty with confidence. Career planning in

places of learning is usually limited to training students for *one* job, instead of multiple jobs, or portfolio careers, or other multiplicities of work. Similarly, alternative futures thinking in the classroom could be used to challenge predetermined notions of the future of education, especially the one premised on globally- and technologically-driven education. Education for alternative futures intends to enable learners to see different futures, including collapse futures, spiritual transformation or even a peaceful middle east (Inayatullah, 2008).

2.4.5 Alignment

The day-to-day operations need to be aligned with strategy, and the strategy needs to be aligned with the image of the future, and the future image with our vision. For educational institutions, this concept contends that a vision for the future is important, and that the vision needs to relate to strategy and metrics. Additionally, casting the vision in stone is not an option; it must remain flexible, in line with the variable conditions. Organisations and societies need to transform by ensuring internal alignment (this means finding out if our story of the future dovetails with our actions in the present). Checking for external alignment means questioning whether our actions in the present link with our plan for the future (Inayatullah, 2008). The cornerstone of this effort is to suitably align a set of useful policy initiatives and business strategies of tertiary education institutions with the vision of a broadened view of education's role in skills transformation.

2.4.6 Models of social change

Is the future of the South African tertiary education considered to be positive, and can it be influenced? Models of social change refer to a futures concept that considers the concepts of agency (influence) and structures (patterns), as well as our subjective outlook in relation to the future. By reviewing the width and depth of foundational futures concepts, a realisation that the future is an open space materialises. Consequently, this future can be influenced. The primary role of a futurist is to disrupt dominant ways of thinking and knowing the future through stylish futures questioning, so that alternative recourses and choices may surface for consideration (Inayatullah, 2008).

2.4.7 The uses of the future

Futures thinking may simply comprise foresight training, aiding both the employees and institutions with novel capabilities and skills (Inayatullah, 2008). Alternatively, at a deeper level, futures thinking is applied in this research study to create capacity and help in the creation of more effective business strategies and innovative educational solutions for skills transformation. Through having a grasp of the alternative, used and disowned futures (Inayatullah, 2008), educational institutions and augmenting stakeholders can become far more creative and proactive in creating the desired future of education for South Africa.

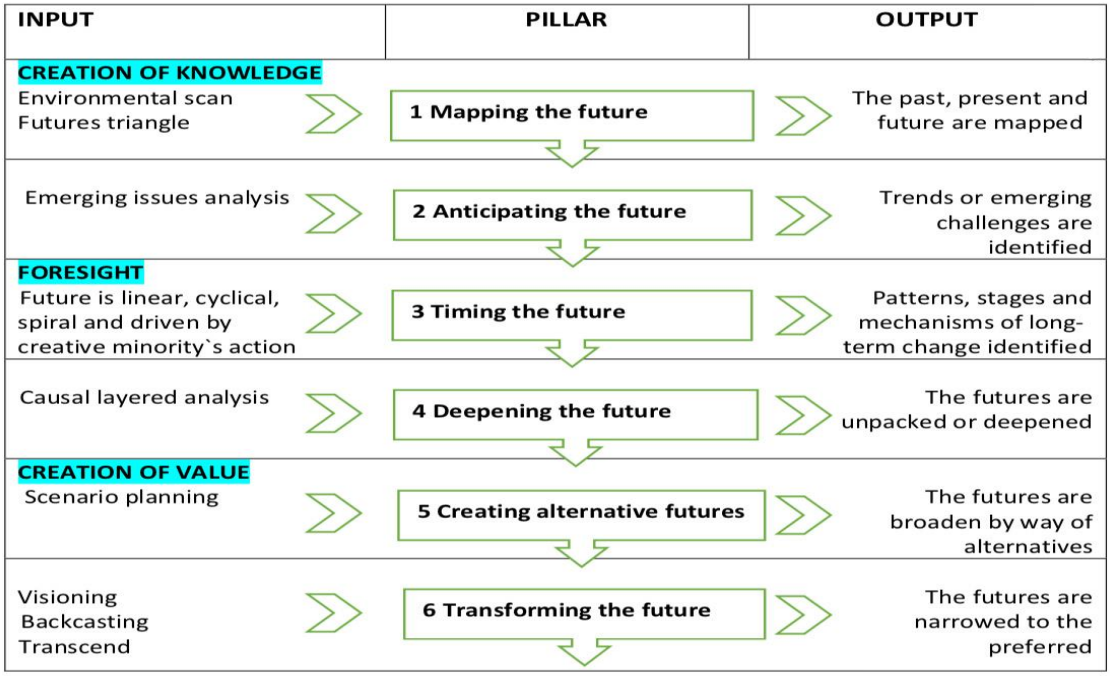
2.5 THE SIX PILLARS OF FUTURES STUDIES

The educational futures in this study were mapped using the Six Pillars of Futures Studies formulated by Inayatullah (2013). This framework provides this research effort an opportunity to manage the process of questioning the past, present and future meanings behind our images of the future in an ordered and analytical manner. The Six Pillars of Futures Studies were applied throughout the research effort, with each pillar being used in a logical sequence to facilitate natural linkages. According to Inayatullah (2005), the Six Pillars of Futures Studies were developed through practice. They provide a theory of futures thinking that is tied to techniques (methods) and tools. These six pillars include:

- Mapping;
- Anticipation;
- Timing;
- Deepening;
- Creating alternatives; and
- Transforming (Inayatullah, 2008).

The conceptual framework for this study, based on the six pillars of Future Studies, is presented in Figure 2.3 below. The framework is intended to show a systematic input-output process detailing the techniques applied and expected outcomes. It thus provides a useful framework in which to explore, interpret and create alternative futures.

Figure 2.3: The conceptual framework of the Six Pillars of Future Studies



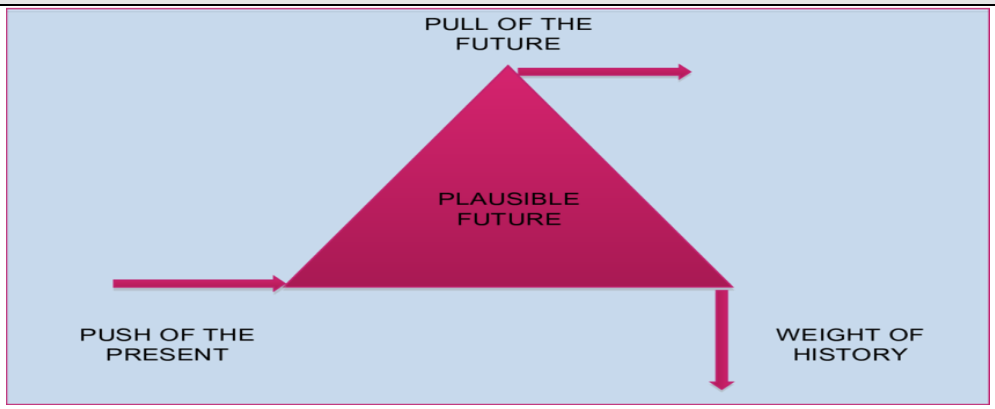
Source: Adapted from Inayatullah (2008, 2013)

2.5.1 Mapping

Firstly, in mapping, there is gathering the shared history of education. The purpose is to create an understanding of current educational situations through exploring what has changed and, more importantly, what has not changed (Inayatullah, 2005). Past, present and future are mapped in the first pillar to reveal where tertiary education came from and where it is headed (Inayatullah, 2008). An environmental scan (ES) of the tertiary education sector was performed to uncover the existing trends and driving forces influencing the future of the industry. Environmental scans deliver strategic intelligence through the identification of situations, emerging issues and possible pitfalls that could affect the future of an organisation or industry. Slaughter (as cited in Puglisi, 2001) outlines how environmental scanning institutes organisationally relevant criteria to allow prepared human minds to discern information, knowledge and insight from the multitude of 'signals' that occur daily. The information can be derived from very different media sources, including conferences, reports and fiction. Four types of indicators can be examined: lone signals, landmark events, statistical descriptions (previous studies) and forecasts of experts (Neufeld, 1985).

The second part to mapping the future is to discern those forces that create a particular future. This can be done through the application of a futures triangle (see Figure 2.4). The process has three key dimensions: push, pull and the weight of the future. The push (key drivers of change) for education can include: FIR and technology, economic industries, sustainability, demographic profiles etc. The pull indicates the official, and sometimes feared, image of the future, as held by different stakeholders – they tend to conflict or compete with each other. The weight of the past (barriers to the envisaged change) resists the forces of change and can include: organisational and societal structures, past histories and patterns of behaviour (Gould, 2008; Inayatullah, 2008). Thirdly, mapping seeks to situate the focus for the future in one of four levels in the 'futures landscape' (Inayatullah 2007). Through mapping, the study was able to determine the level of awareness on current assumptions about the future of education.

Figure 2.4: Futures triangle



Source: Inayatullah (2008)

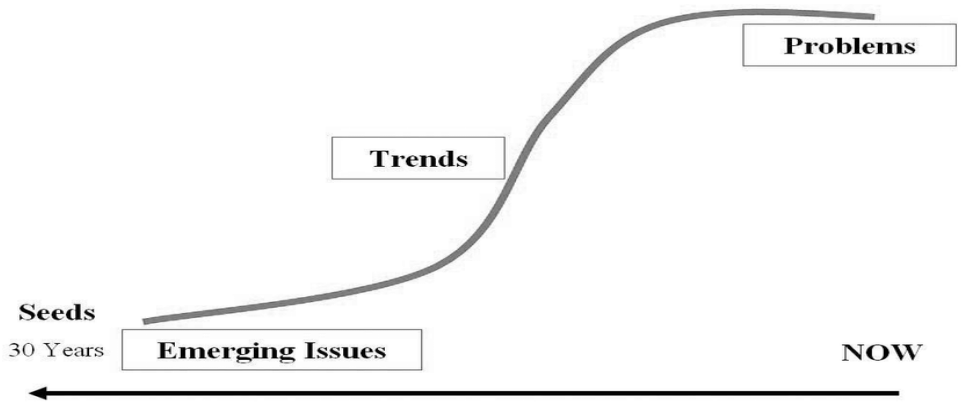
2.5.2 Anticipation

Data gathered during the ES in the initial mapping phase may be understood via this pillar of futures thinking, when an analysis of the emerging issues (see Figure 2.5) and drivers is performed to identify regions in which social innovation can begin (Inayatullah, 2008). In this study, critical questions about tertiary education in South Africa were considered. This is in accordance with the guidelines recommended by Horton (1999), who considers the response to these important questions vital to the process of foresight creation:

- What does skills transformation mean for the tertiary education in South Africa?
- What are the consequences for the stakeholders?

- What are the concerns that challenge the realisation of the future?
- What can be done about it today?

Figure 2.5: Emerging Issues Analysis



Source: Inayatullah (2005)

Emerging issues analysis tries to plot a possible ambit of current difficulties or issues (Gould, 2008), and aims to isolate problems before they become unmanageable and costly, while searching for novel opportunities (Molitor, 2003).

2.5.3 Timing

Timing involves macrohistory and the study of grand patterns of social change. According to Galtung & Inayatullah (1997, p. 159), macrohistory is "the study of a trajectory of a unit through time and the study of non-contiguous points, neighbourhoods, and contexts, while searching for patterns, regularities and change." Implementing macrohistory as a method provides the opportunity to step back and differentiate between regular disturbances and real transformations from a longer-term view about the past, present and future (Inayatullah, 2005).

Will the creative minority generate a new educational system? Is deep change impossible? Does change come from inner reflection? Is technology the most important force that it determines how we work, teach, learn and play? These questions, in turn, engender wider speculation, including how the future is timed. Is the future a planned, coherent action created by selection and risk analysis, or is the future completely open and anything probable? Macrohistorians and grand thinkers have been grappling with these questions for millennia

(Galtung & Inayatullah, 1997; Voros, 2006) and, from their thinking, certain central but divergent ideas have arisen:

- The future is linear, good, progressive and attainable through commitment and hard work.
- The future is cyclical: those at the top are powerless to adapt and will one day in the future find themselves at the bottom.
- The future is spiral-shaped: bold leadership with foresight can create a positive spiral by taking ownership of the past and incorporating it in the roadmap of an ideal future.
- New futures are frequently driven by a creative few, thus challenging the idea of a used future through political, spiritual, cultural, social or technological innovation.
- There are pivotal periods in human history when the actions of a few can result in a spectacular transformation. Conventional means of behavioural management are no longer effective during these periods. (Inayatullah, 2008).

2.5.4 Deepening the future

Through the fifth pillar, the understanding of the future is deepened through observing the same issue from many perspectives or ways of knowing. Causal layered analysis (CLA) and the four-quadrant mapping are two methods that can be used for deepening of the future. CLA works by selecting an issue and conceptually unpacking our comprehension of the issue from four levels of interpretation, namely: litany, social systems, worldviews and viewing an issue in terms of myth or metaphor (Inayatullah, 2008). CLA as the chosen primary research methodology for this research endeavour will be discussed in detail in Chapter 4. The four-quadrant mapping develops the inner dimension of CLA (Slaughter, 2005) by investigating the following four features:

- The inner-individual – the meaning given to the world that must be altered;
- The outer-individual – the conduct;
- The outer-collective – the approved strategies undertaken by businesses; and
- The inner-collective – the internal map of organisations. (Inayatullah, 2008).

2.5.5 Creating alternatives

Alternative futures formulation happens in the fifth pillar. Alternative futures methods are based on scenario development. Multiple scenario techniques exist: single variable, double variable, organisational, anticipatory, archetypes and integrated (Inayatullah, 2008). Using four scenarios, one can articulate how an organisation may appear in each alternative future (Inayatullah, 2008). Peter Schwartz's scenario construction framework will be used in this study and will also be explained in Chapter 4. There are four variables in this structure:

- Best case (towards which the establishment wishes to move);
- Worst case (most severe possible outcome);
- Outlier (an unexpected future grounded on a disruptive developing problem); and
- Business as usual (no alteration). (Inayatullah, 2008)

Scenarios evoke a sense of empowerment and stimulate action to create alternative images, thus offering choice and capacity for change (Inayatullah, 2005). Scenarios are unparalleled as a tool of Futures Studies. They unlock the present, navigate the spectrum of uncertainty, act as an early warning sign, offer alternatives and, even better, predict (Inayatullah, 2008). Scenarios tend to be constructed from the macro environmental perspectives about what the future is likely to contain. Dator (2002) explains these views as archetypes, which are expressed as:

- Continued growth along current lines;
- Collapse;
- Disciplined society; and
- Transformation or outlier.

2.5.6 Transforming the future

The desired future can flow from scenarios. The future can be narrowed toward the preferred through a process of questioning. For example, what will work look like? How does an individual learn? Where does one learn? Through which technological platform? The preferred future can also be created through a process of creative visualisation (Inayatullah, 2008a). Back-casting is another future-transforming process that is worth mentioning, which connects the vision to the present day in terms of time and space. Back-casting is valuable for pointing

out key milestones and indicators that aid in defining manageable chunks of time and events that collectively contribute to the achievement of the vision (Gould, 2008; Inayatullah, 2008).

2.6 CLASSIFICATION OF METHODS

2.6.1 Four types of Futures Studies research frameworks

Envisioned images of the future for society are situated in four types of Futures Studies research frameworks:

- **Empirical:** the objective world exists and we can know or seek to control the future – that is, knowledge is built.
- **Interpretive:** subjective images of the future. The objective world exists, but there are various versions; the future can be brokered.
- **Critical:** the objective world is thorny. The aim is to disturb power relations that framed the future. We have come to know the future through the politics of language and structure.
- **Anticipatory action learning:** the aim to fashion alternatives by questioning the future. Reality is process-based and the future is not set but incessantly being revisited by active learning experiments (Inayatullah 2007).

2.6.2 Epistemology

The epistemology of futures research methods can be either positivistic or interpretive. According to Gray & Hovav (2011), in positivistic research, the assumptions lead to premises, which are then investigated using, for example, Delphi or cross-impact analysis. On the other hand, interpretive subjective processes lead to different alternatives (scenarios). In both interpretive and quantitative research, the role of the researcher is key in the sense that the researcher's values and beliefs will guide and frame their investigation. By determining the necessary dimensions and driving forces in advance, the researchers can justify their suppositions and the logical advancement of their arguments (Gray & Hovav, 2011).

2.6.2.1 Interpretivism

Interpretivism ties in with qualitative methods (Collis & Hussey, 2014). The ontological premise of interpretivism, according to Yin (2015), is that social reality is subjective and socially fashioned, hence the plurality of realities. The epistemological assumption is based on the interaction of the researcher with the occurrence under study and one cannot discard the knowledge that comes from the contributors' subjective evidence. Thus, qualitative research accentuates quality through the depth and richness of primary data collected. The main positive aspect of qualitative exploration is its ability to facilitate in-depth studies about an extensive array of themes, revealed in an unsophisticated and day-to-day manner (Yin, 2015). Hence, this research paradigm encompasses an inductive method with a vision of providing an interpretative understanding of social sensations within a particular context (Collis & Hussey, 2014).

2.6.2.2 Positivism

Positivism originates from Natural Sciences. It posits that social reality is objective and singular, and is not impacted by the act of examination This research comprises a deductive process, with a view to supplying explanatory theories through which to understand social singularities (Collis & Hussey, 2014). The marriage of positivism with quantitative research methods is important, considering that positivism is based on truth-finding, and presenting it by empirical methods. It is therefore critical that a chosen quantitative research methodology ensure the accuracy of the measurement (Thomas, 2010; Wahyuni, 2012; Collis & Hussey, 2014).

2.6.3 Mixed methods research

According to Creswell (2014), mixed methods inquiry calls for philosophical assumptions, the application of qualitative and quantitative methodologies, and the combining or blending of both approaches in a study. Mixed methods research is relatively novel in the Social and Human Sciences as a unique research approach, and various phrases are used for this approach. They include: *amalgamating, synthesis, quantitative and qualitative methods, multi-method*, and *mixed methodology* (Bryman, 2006; Tashakkori & Teddlie, 2010). There is a plethora of mixed methods designs, and the reason for electing a certain mixed methods approach hinges on a

multitude of factors that relate to the intent of the procedures, as well as practical considerations (Creswell, 2014). The reasons for choosing mixed methods research include:

- The ability contrast varying perspectives from interpretivism and positivism data.
- Designing superior instruments for measurement.
- Comprehending experimental outcomes by including personal perspectives.
- The ability to justify measurable results with qualitative data. (Creswell, 2014)

2.7 VALUES AND ETHICAL CONSIDERATIONS

According to Dator (1998), the consideration of ethics is vital to Futures Studies; there can be no pretence of splitting the deliberations of good and bad, beauty and ugliness, right and wrong, or other core values from academic analysis into the future. The role values play is critical such that values must be debated upfront and in every stage of Futures Studies and consultation (Dator, 1998). Akintan (2014) provides guidelines for futurists to consider when formulating a professional code of ethics:

- Futurists should embrace honesty, respect and trustworthiness when carrying out their roles.
- Futurists should accept accountability for the facilitation and development of humanity's ethical codes (including sustainability and rule of law), and furthering the greater good.
- As in academia, futurists are obliged to search for the truth and to test ideas empirically and logically as far as possible before reporting on their research works.
- Futurists, as consultants, should avoid unethical behaviours, such as self-serving, padding expenses, withholding information and breaching confidentiality. (Akintan, 2014)

2.8 DATA RELIABILITY AND METHODICAL RIGOUR

Because any statement or assumption regarding the future cannot be verified at the time of its establishment, Kreibich et al. (2012) describe futures as a unique field of study. Pace and scale

of change makes it impossible to predict the future; Futures Studies does not claim to have predictability power (Glenn, 2009). The aim is to give more clarity about the future and unearth opportunities that may exist. However, there are reliable procedures in place to ensure that futures-oriented knowledge is of high quality (Dator, 2007; Kreibich et al., 2012). Reliability is ensured when research efforts avoid starting with the assumption that the research objects of Futures Studies can be isolated from their environment (Kreibich et al., 2012). Unlike traditional quantitative research, where internal validity is measured statistically, in Futures Studies, internal validity guidelines need to be developed. The guidelines are methodology dependent. In scenarios, for example, the relationships among diverse outcomes need to be plausible, possible and internally consistent (Gray & Hovav, 2011).

Credibility can be assured by collecting data from multiple sources and means of triangulation of different methods of data collection (Yin, 2015). The researcher intends to follow the following principles:

- To be open and attentive to new observations and discoveries as part of the literature review;
- Presenting the truth honestly and without bias;
- Report multiple perspectives and contrary findings;
- Give credit to advisers in the visioning process (Creswell, 2014).

2.9 CONCLUSION

This chapter has provided an overview of the futures research methodology and its application to tertiary education. The description and presentation of the six pillars of future studies as the *par excellence* framework to study the future of the tertiary education institution was done. It shows how the generation of the background information from the mapping pillar feeds into the Casual Layered Analysis tool, which is not only an analysis methodology but also a data collection tool so that the education scenarios can be developed. The research process has five stages: a review of appropriate literature, knowledge creation, foresight, value creation and reflection.

Chapter 3 will present a summary of the available literature as revealed by the environmental scan of the tertiary education sector. The aim is to uncover mega trends and key drivers of change for the South African tertiary education institution towards 2030.

CHAPTER 3

LITERATURE REVIEW

3.1 INTRODUCTION

Despite all grand changes in technology, demographics and society, the education process is still rooted in the 20th century mind-set (Milojević, 2014). Although academics pride themselves on their intellectual creativity, universities have not kept pace with changes in careers or the other massive changes mentioned above. The corporate world, the military or even religious practices have seen better change when the core model for higher education has pretty much stagnated (Calhoun, 2017). The lack of productivity and efficiency in education is huge when compared to the health sector where technology has fuelled outcomes. The same is not true for education in terms of the balance between resources invested and the outcomes in relation to learners' performance and equity (OECD, 2016c).

Cathy Davidson's book entitled "New Education" posits that student-centeredness, online courses and active learning can lead the change in learning places. Davidson (2017) criticises disciplinary departments for being too dominant and out of touch, since neither the jobs nor challenges in the world are fashioned exclusively by academic disciplines (Davidson, 2017). Marshall McLuhan (1967) wrote, "Anyone who tries to make a distinction between education and entertainment doesn't know the first thing about either." The argument here is that the aim is not to merely entertain students, but to engage them through relevant and experiential learning opportunities (Chen & Hoffman, 2017). As a result, gamification is becoming prevalent, due to the realisation that creating a fun and engaging environment gets students interested in the world around them (Katz & Chard, 2010; Chen & Hoffman, 2017)

Many citizens are asking their countries to make a concerted effort to develop robust national innovation policies for the education sector, since people devoid of ICT experience have the lowest labour force participation rate in all nations (OECD, 2016c). Not only that, but possessing digital skills improves a worker's prospects in life, as it affects employability. The advocates for educational innovation tie in successful innovation in organisations and economies as a by-product of quality education and skills (OECD, 2016c). However, in as much as technology is a catalyst, the goals in tertiary education, not technology, must drive the

vision of the future. By accepting that technology is just a tool with advantages and limitations, the focus is brought back to the *purpose* of tertiary education. In this case, it refers to the preparation and skilling of the workforce (Butin, 2015).

Innovation in education improves learning competencies and delivery quality, increases accessibility and equality, reduces costs and enhances relevancy in an ever-changing environment (Barrett, 1998; OECD, 2016c). If the main goal of education is cultivating curiosity and creativity, then traditional materials will lose their shine, as new technologies will guide students in how to learn and work in a digital age (Vermeulen, 2017). Additionally, building a lifelong learning culture in the workplace demands a pivot from education for employment to education for employability. It also requires people to stop relying on "job security", but find comfort in "career security" (WEF, 2017d).

The need for more highly skilled graduates has never been greater. PwC (2017) postulates that the increased demand for STEM skills to build a new tech ecosystem is only for today. Tomorrow, one would need emotional intelligence, creativity, persuasion and innovation to become more valuable. The future will have no hope for people devoid of rudimentary STEM skills, because adaptive intelligent systems will assume decision-making responsibilities, putting the future of unadapting humans at work in peril. According to Shay (2017), about a third of those enrolled in South African universities will have dropped out in the first or second year, and 40–50% will not graduate at all (Govender; *Sunday Times* 2018). Interventions should be in place to reduce dropout rates and improve graduation rates. Without investment, it will not achieve the policy goals of equity of access and effective education delivery (Shay, 2017). Funding and access to education are not the focus of this study. However, it is imperative to tease out some of the issues that have an effect on skills transformation.

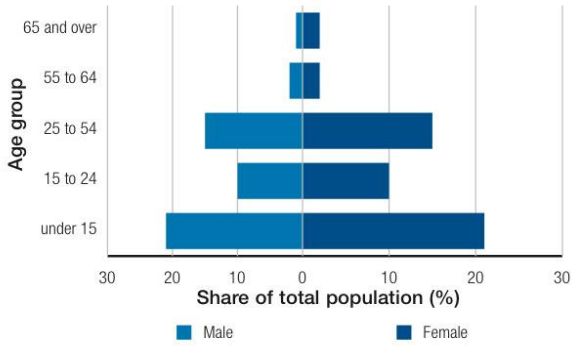
South Africa's skills problem is not going to be solved by individual universities mandating the right mix between diversity and cosmopolitanism in their recruitment of students and staff, but a differentiated tertiary education system that produces optimally skilled and qualified professionals (Habib, 2016). No university can act on all the forces changing the universities, but there are spaces for agency. It could be by ensuring more multi-cultural content, showing solidarity, meeting students' changing needs, or creating alternative universities (Inayatullah & Gidley, 2000). A differentiated higher education system envisages universities that teach undergraduate students, produce professionals, create postgraduate students that undertake

high-level research and that have a TVET sector that produces graduates with vocational and applied skills (Badsha & Cloete, 2011; Habib, 2016).

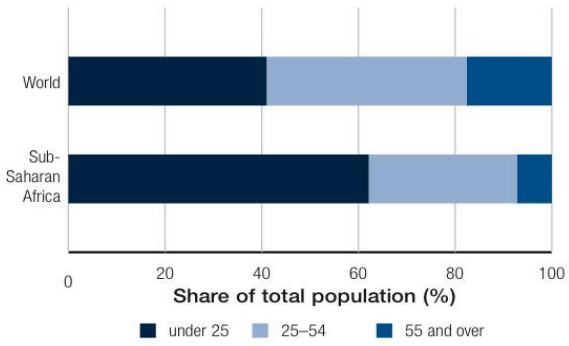
According to WEF's Human Capital Index (2016), Sub-Saharan Africa only captures 55% of its human capital potential relative to a world average of 65%. With six in ten people under the age of 25 (see Figure 3.1), Africa's working-age population is on its way to increase to over 600 million by 2030 (that is, within 20 years). Correspondingly, the number of people with a secondary education is set to grow from 36% in 2010 to 52% in 2030 (WEF, 2017c).

Figure 3.1: Sub-Saharan Africa's demographic structure

Demographic structure



Population distribution by age



Source: United Nations Population Division (2016)

3.2 DRIVERS OF CHANGE

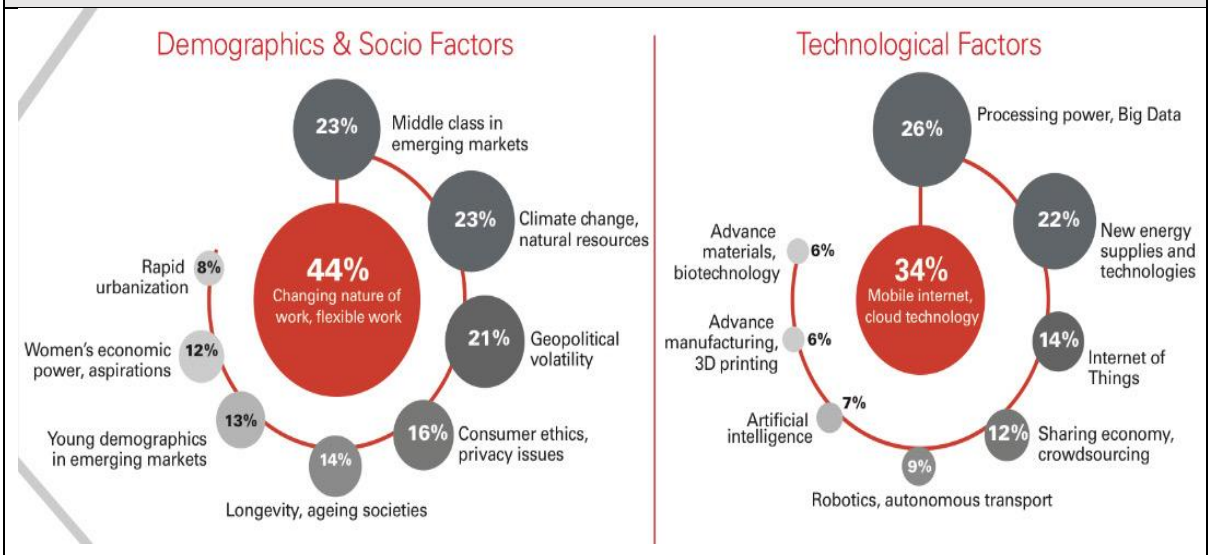
There are many ways to identify the challenges of change in tertiary education (EY, 2018). One way is to look at the disruptive forces of change causing unprecedented challenges in many sectors (Boston Consulting Group [BCG], 2018). These forces represent significant disruptive shifts that are likely to have serious implications on the nature of future work and, consequently, to change the skills of the future (Scott, 2015). FIR brings with it different education needs of the future workforce. It is incumbent upon leaders of tertiary education institutions to be in front of a changing world of work and learn by taking into account future-focused thinking into their grand plans, adopting trends that have the maximum effect (BCG, 2018). The global community has been rocked by protectionism, anti-establishment voting, deepening social and political polarisation and less cooperation when it in fact requires collaboration across multiple interconnected systems (WEF, 2017a).

3.2.1 The Fourth Industrial Revolution

The Fourth Industrial Revolution (FIR) is usually described as Cyber Physical Systems (CPSs) (Drath & Horch, 2014), although CPSs is but one part of the FIR. It is therefore a common mistake among many to confine FIR to industrial production, since it spans all facets of society, including technology, production, consumption and business (Schwab, 2016; Guoping, Yun & Aizhi, 2017). Technology-enabled platforms breed sharing economy, which has led to the biggest start-up (Uber is an example of this). These platforms, which are easy to use on a smartphone, create entirely new ways of consuming goods and services (Schwab, 2016). FIR is also known as Industry 4.0, which is a term used to describe how physical, biological and virtual systems enable product customisation and the revamping of operating models. Unlike the Third Industrial Revolution, Industry 4.0 is an end-to-end digital ecosystem with value chain partners (PwC, 2016).

3.2.1.1 Drivers for the Fourth Industrial Revolution

Figure 3.2: Drivers for the Fourth Industrial Revolution



Source: World Economic Forum, Future of Jobs Survey 2016

Breakthroughs in robotics, 3D printing, nanotechnology, materials science, energy storage and quantum computing means the reshaping of production, consumption and delivery systems (See Figure 3.2). 3D printing will usher in 4D, which will be able to create self-altering cloths or shoes capable of responding to temperature changes. Graphene, a nanomaterial, is 200 times

stronger than steel, a million times thinner than a human hair, and an efficient conductor of heat and electricity (Schwab, 2016). Neuro-technology, which can control prosthetic limbs or wheelchairs, has also enhanced education, communication, intelligence and disease treatments (Guoping et al., 2017). Already, IBM's Watson supercomputer can help recommend personalised treatments for cancer patients by comparing the histories of disease and treatment, scans and genetic data against recent medical knowledge (Schwab, 2016).

3.2.1.2 Effects of the Fourth Industrial Revolution

There is a correlation between growth, GDP, investment, consumption, employment, deflation and FIR (Schwab, 2016). The FIR is providing impetus for economic growth, thus accelerating the return of manufacturing to developed countries, because smart factories put these countries in a better position to challenge low-cost factories in Asia (Guoping et al., 2017). Green economies are a by-product of this revolution too. The UK government, which will cease to sell fuel combustion vehicles by 2040, will see economic benefits to the value of £51 billion in 2030, generated by autonomous vehicles (KPMG, 2015).

Schwab (2016) concedes that the FIR has four main effects on business: customer expectations are being redefined into experiences (e.g. the Apple experience), data-enhanced products (e.g. Tesla's car appreciating in value through software updates), new partnerships, as well as the transformation of operating models into new digital models (e.g. not owning CDs, but streaming music). The disruptive nature of an on-demand economy is killing current businesses and creating new businesses for now and the future (Schwab, 2016).

FIR brings flexibility in terms of working remotely, but complicates employment and tax laws, creates jockeying for skilled workers, and potentially weakens employment protections (WEF, 2017a). Employment protections common to "standard" workers are absent in sharing and collaborative economy. These are being replaced by zero-hour contracts, which are characterised by volatility in earnings (WEF, 2017a). These changes coincide with four mountainous challenges, including straining safety nets, persistently low interest rates, mass migration of labour and massive income inequality (WEF, 2017a).

3.2.1.3 Managing the Fourth Industrial Revolution

In order to take advantage of the FIR, there is need to balance the benefits and cost mitigation through quality governance (WEF, 2017a). Managing emerging technologies is no small task, because regulating too heavily, too quickly can stifle advancement and hold back progress. At the same time, lack of governance can compound risks leading to disgruntled investors and innovators. Biotechnologies tend to bear the brunt of heavy regulation and slack governance is seen in AI. See Table 3.1 below for a list of critical emerging technologies.

Table 3.1: Key emerging technologies

Technology	Description
3D printing	Advances in additive manufacturing, using a widening range of materials and methods; innovations include 3D bioprinting of organic tissues.
Advanced materials and nanomaterials	Creation of new materials and nanostructures for the development of beneficial material properties, such as thermoelectric efficiency, shape retention and new functionality.
Artificial intelligence and robotics	Development of machines that can substitute for humans, increasingly in tasks associated with thinking, multitasking, and fine motor skills.
Biotechnologies	Innovations in genetic engineering, sequencing and therapeutics, as well as biological-computational interfaces and synthetic biology.
Energy capture, storage and transmission	Breakthroughs in battery and fuel cell efficiency; renewable energy through solar, wind, and tidal technologies; energy distribution through smart grid systems, wireless energy transfer and more.
Blockchain and distributed ledger	Distributed ledger technology based on cryptographic systems that manage, verify and publicly record transaction data; the basis of "cryptocurrencies" such as bitcoin.
Geoengineering	Technological intervention in planetary systems, typically to mitigate effects of climate change by removing carbon dioxide or managing solar radiation.
Ubiquitous linked sensors	Also known as the "Internet of Things". The use of networked sensors to remotely connect, track and manage products, systems, and grids.
Neurotechnologies	Innovations such as smart drugs, neuroimaging, and bioelectronic interfaces that allow for reading, communicating and influencing human brain activity.
New computing technologies	New architectures for computing hardware, such as quantum computing, biological computing or neural network processing, as well as innovative expansion of current computing technologies.
Space technologies	Developments allowing for greater access to and exploration of space, including microsatellites, advanced telescopes, reusable rockets and integrated rocket-jet engines.
Virtual and augmented realities	Next-step interfaces between humans and computers, involving immersive environments, holographic readouts and digitally produced overlays for mixed-reality experiences.

Source: World Economic Forum Handbook on the Fourth Industrial Revolution (2017)

3.2.1.4 The disruptive impact of Emerging Technologies

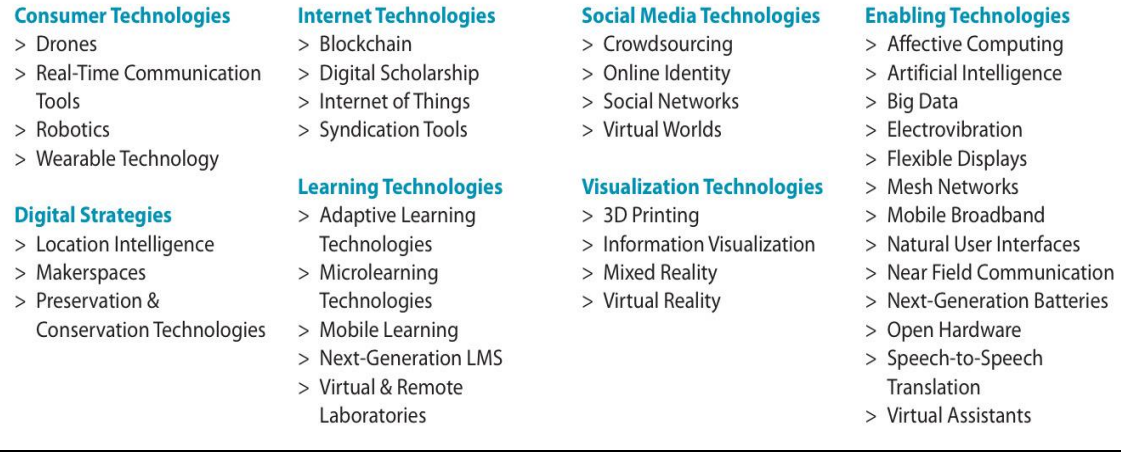
The disruptive potential of emerging technologies continues to loom large and as these technologies take root, many business models are left on shaky ground (WEF, 2017a). The FIR is not only reshaping the businesses of the future, but also reshaping the employment outlook. A negative impact of the FIR is the generation of structural unemployment (Guoping, 2017). The FIR seems to be creating significantly fewer new positions than previous revolutions. However, the revolution may create new occupations, businesses and even industries (Schwab, 2016). The intricacies of global risks mean that technological changes have multi-pronged effects on the risk landscape. Disruption in the labour market is often associated with increased unemployment, which in turn leads to social instability (WEF, 2017a).

A cocktail of exponential progress, high volatility and future predictions are delicate for a linearly thinking human mind (Fadel, 2015). In 15 years, iPads will be regarded as part of the common infrastructure (Joy, 2012) and brain-implanted devices will most likely be the norm (Monks, 2014). In the USA, 6-10% of the jobs will sink into oblivion because of driverless cars (Santini, 2016) and car ownership will revolutionise the culture of mobility through systematic travel options (Kosoff, 2016; Inayatullah, 2017). Mental health and substance abuse social workers' jobs are safe from automation, because their work involves "cleverness, negotiation, and helping others" (Bui, 2015). The massive disruptive potential of digitalisation leads to important questions: what will automation do to jobs? Is there creation of new jobs? and what competencies will they require? Though the future of work is unclear, one thing is certain: the jobs and skills of tomorrow will be different from yesterday's (Seager, 2016).

3.2.2 Technology trends in education

Technology has been at the centre of creating new trends in many fields, and the ease at which people are able to operate devices has enabled both children and the elderly accessibility to digital learning material. Even blind people can interact with the material through voice recognition and haptic tools (Gamper & Nothelfer, 2015). Different studies have emerging and existing technologies that are useful in both education and beyond. NMC, for example, tracks seven categories of technologies, devices and grand plans pertinent to learning and creative enquiry (Adams et al., 2017). See Figure 3.3 below, which is by no means an exhaustive list.

Figure 3.3: Relevant educational technologies



Source: NMC (2017)

3.2.2.1 Human computer interaction

Natural User Interfaces (NUIs) have a four to five year adoption time in creating novel domains of scientific inquiry and application in education. It is good news that many NUIs enabled devices respond to gestures, facial expressions, eye-movements, tactile sensations and voices (Adams et al., 2017). The wide use of Alexa, Siri (speech recognition) and the Apple watch (haptic-enabled wearable devices) mean that interactions between man and machines is at an advanced stage (Gamper & Nothelfer, 2015). Apple is experimenting with Siri to use voice biometrics for user authentication. Researchers at the University of Sussex are piloting interfaces that use skin as a touchscreen (SkinHaptics), which is a tool that sends ultrasound waves through the back of the hand to a screen display on the palm (Adams et al., 2017). Improved usability in voice, text and gesture recognition paves way for future students to interact with devices in the same fashion as if they were interacting with educators today (Gamper & Nothelfer, 2015).

3.2.2.2 Machine learning

Humans are no match for machines when it comes to logically processing huge volumes. As far back as the 80s, machines were even surpassing human professionals in certain medical fields (Szolovits, 1982). Precipitated by university and institutional research and funding algorithms, machines will take over the planning of lectures, the dispatching of learning material and convocation of differentiated exercises (Gamper & Nothelfer, 2015). Since the

50s, the Turing Test has been the gold standard for machine intelligence until the test was conquered in 2014. Prior to that, it seemed impossible that a person would be unable to differentiate between a machine and a person in conversations and real-world situations. As a result, the use of AI is now predominant in tertiary learning institutions in the form of 24/7 online help desks (Adams et al., 2017).

3.2.2.3 Mobile learning

Self-paced learning is now possible due to the proliferation of mobile devices, which allows students to learn on the go in a fun and interactive way. "Duolingo", a language app uses gamification and social aspects to facilitate students learning the fundamentals of several languages anywhere, anytime, in short bursts. Learners will be less constrained to their classical learning environments. Venture capitalist are acting as key drivers of this because of their excitement in on-the-go learning start-ups (Gamper & Nothelfer, 2015).

3.2.2.4 Big data

The exponential growth in data emitted by digital devices has seen big data as a trend that will continue to shape many public and private educational institutions (Gamper & Nothelfer, 2015). Educational institutions are now classifying the ability to analyse big data as a prerequisite skill for the future. Not only that, but financial institutions are huge investors in big data (Big Data Executive Survey, 2014).

3.2.2.5 3D printers

3D printers have been a game changer in the manufacturing realm because of costs savings inherent in additive process, as well as its ability to build complex objects. As a result, objects that could only be found in textbooks can be 3D-printed and experienced in classrooms. Architecture lectures, for example, will greatly benefit in universities (Gamper & Nothelfer, 2015).

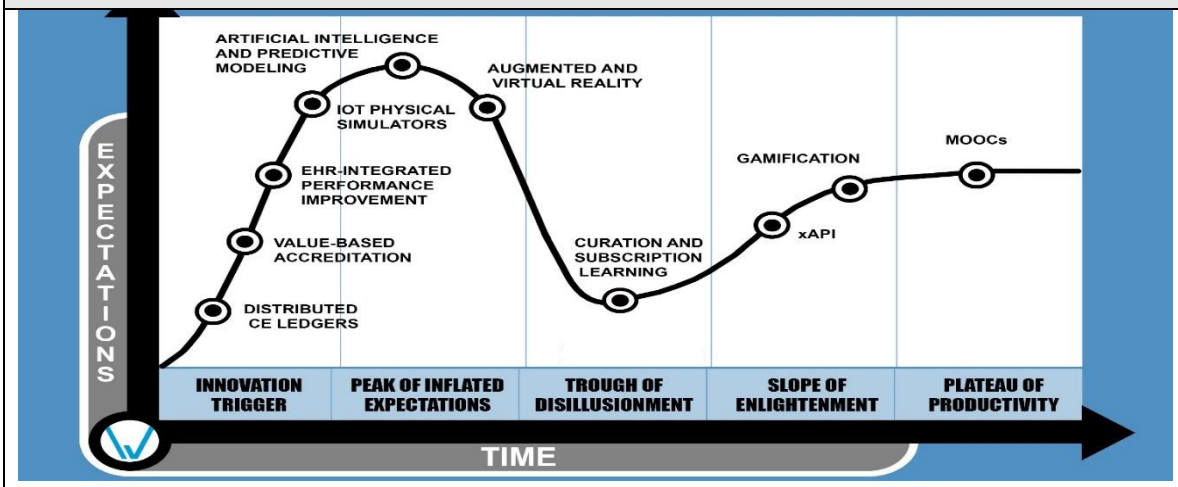
3.2.2.6 Digital teaching platforms

Digital advancements have disrupted many industries and they are expected to do the same in education, although not to the extent that campus-based university will disappear (EY, 2012). Online teaching platforms like Google Classroom aid classroom and curriculum management, allow for instantaneous learner assessment, as well as facilitative interaction between the learner and educator (Gamper & Nothelfer, 2015). The Bring-Your-Own-Device (BYOD) and other collaboration tools make it possible to deliver graphical and textual content to their devices while student engagement happens through peer-to-peer learning (Peasgood, 2014). In Texas, virtually all districts have these learning management systems, because educators realise the huge savings and improved learner outcomes (Pozo-Olano, 2018).

3.2.2.7 Massive Open Online Courses (MOOCs)

In an endeavour to realise global education, MOOCs allows access to quality educational content through the web, even to people in remote areas. Additionally, full-time workers are able to take advantage of MOOCs to gain novel knowledge, capabilities and competencies. In as much as the democratisation of education is a big driver, universities are using MOOCs to improve their image globally (Gamper & Nothelfer, 2015). However, there is a concern that MOOCs will undermine traditional undergraduate enrolments. Butin (2015) argues that many people struggle with "futuring" the real future in higher education, because institutions take the "next big thing" (for example, taking the traditional model and replicating it onto an online platform) and expand the existing structure from the inside out. Tertiary institutions should instead take the "next big thing" and embed it within the existing structure from the outside in (Butin, 2015). The hype about MOOCs began to fade because of the inability to monetise online material (Gamper & Nothelfer, 2015) and the Gartner's hype cycle predictated MOOCs reaching their plateau of productivity in 2018 (see Figure 3.4).

Figure 3.4: 2018 Hype cycle eLearning predictions



Source: Web Courseworks (2018)

Contrary to popular belief, MOOCs are not obsolete (Hicken, 2017). Universities experimented with the Coursera model and took lessons from it. In the process, they created a new educational system that met the working class' need for credentials, while on the job. The sudden appetite for MOOCs has been because of a shift to quasi-MOOCs, and not the purist's form of MOOC. A closer look at the new class of online master's degrees reveals that it is not totally open, but it is more open in the sense that students are not shackled to the traditional barriers of paying full tuition or showing up physically at a campus at prescribed times (Hicken, 2017).

3.2.2.8 Augmented and Virtual Reality

Gartner's hype cycle (2018), shown in Figure 3.4, suggests that Augmented Reality (AR) and Virtual Reality (VR) have reached the peak of inflated expectations in 2018. Technavio report (2018) predicts that will grow at a 55% compound annual rate surge in the educational VR market by 2021, and a corresponding projected growth of 82% from 2018 through 2021 in educational AR, to become a $3 billion market in North America alone (Pozo-Olano, 2018). AR not only adds artificial and computer-generated objects to the human's perception of the real world, but allows them to interact with the objects (Gamper & Nothelfer, 2015). Whereas AR overlays educational graphics on the real world, VR creates truly immersive virtual worlds (Hicken, 2017). In a History class, pyramids of old come alive and in Biology, students will see organ systems overlaid on the human body. When students learn foreign languages, they will engage virtual speakers and get instantaneous feedback on their phrasings (Pozo-Olano, 2018). The teething problems in constructing these experiences have waned, because device

manufacturers have supplied application developers with new toolkits for developing applications. However, challenges remain around integrating the AR/VR experience into different learning infrastructure. (Hicken, 2017).

3.2.2.9 Gamification

Gamification is on the slope of enlightenment on the hype cycle (see Figure 3.4). The key drivers for gamification have been increased living standards and the need for higher order stimulation, like play (Gamper & Nothelfer, 2015). Gamification success rates are largely associated with areas of high internet penetration. However, it does not mean that gamification does not work without technology. If anything, many reward programmes have been used in education, which do not require any technological input (Oxford Analytica [OA], 2016). Game-based learning refers to learning activities that are games, and gamification signals the application of gaming exostructure, like points, levels and badges, to learning (Hicken, 2017).

Gamification allows for higher student engagement and, with game-based motivations, students discipline issues decrease, as does the need for the educator's constant supervision of their work (OA, 2016). However, it does not mean that gadgets replace teachers. Educators shift to remote supervising of students' activities, developing flexible learning experiences and facilitating the social capital of learners (OA, 2016). The obsolete rote-learning educational systems have resulted in students and graduates under-equipped for 21st century jobs. The 'educated unemployed' have information, but the skills that are lacking. Gamification is part of the future of education and extensive pilot programmes are required to establish its value in training people to be innovative, entrepreneurial and analytical (OA, 2016). Gamification will be front and centre in the coming years, especially in corporate training and innovation processes, so that mundane materials can be showcased in new and playful ways (Gamper & Nothelfer, 2015).

3.2.3 Key trends facilitating tertiary education technology adoption

NMC horizon reports look at how technological innovations affects higher education worldwide. The 2017 report zooms in on six trends (see Figure 3.5) that are likely to dictate technology strategy in the next half decade (Adams et al., 2017).

Figure 3.5: Drivers of technology adoption in higher education

Source: NMC Horizon Report 2017

3.2.3.1 Advancing cultures of innovation

Tertiary institutions have emerged as powerhouses for innovation through entrepreneurship and invention. Not long ago, universities emphasised the great value of the exploration of new ideas. This exploration becomes a breeding ground for experimentation and differentiated evaluation methods. This is thanks partly to institutions' heeding the call to accept failure as a critical learning process (Adams et al., 2017).

3.2.3.2 Deeper learning approaches

Students are now demanding "deep learning", which facilitates complex engagement with materials (BCG, 2018). At its core, deeper learning approaches, including project-based or inquiry-based learning, facilitate higher-order thinking, problem-solving, team work and taking responsibility for one's learning. Active learning is instrumental for motivation, since students need to link the experiences in their coursework to the real world, and understand how the new competencies and skills will help them in the future (Adams et al., 2017). Besides porting between structured and unstructured learning systems, students want international experiences (BCG, 2018).

3.2.3.3 Growing focus on measuring learning

In line with the need to incorporate and measure soft skills in learning institutions, the quantification of learning trend describes "evaluation, measuring, and documenting academic readiness, learning progress, skill acquisition etc." (Adams et al., 2017). Advancements in data-mining software and technological developments make it possible for places of learning to take advantage of analytics and visualisation software, in order to depict metrics about students in a multidimensional and conveyable fashion (Adams et al., 2017).

3.2.3.4 Redesigning learning spaces

Incorporating digital devices often results in fine tuning classrooms or lecture rooms so that they allow for enhanced mobility, online communication, flexibility and multipronged device usage. Besides introducing faster wireless bandwidth and installing large displays, universities are experimenting with mixed reality technologies. In the end, tertiary education institutions will facilitate real-world work and social settings that organically collaborate and trans-disciplinarily find solutions (Adams et al., 2017).

3.2.3.5 Blended learning designs

Digital learning is advantageous in the sense that it increases creative thinking, self-directed learning and can be individualistically bespoke to each student. By combining online and face-to-face methods, blended learning brings in flexibility and accessibility (Adams et al., 2017). Blended learning is reinventing the learning experience by allowing students to watch videos outside class in order to discuss them in class (BCG, 2018).

3.2.3.6 Collaborative learning

Collaborative learning has its roots in the belief that learning is a social construct and, therefore, people should work in pairs or groups – including educators themselves. Student engagement improves cultural consciousness and enhances openness to diversity through working with students from diverse backgrounds and demographics (Adams et al., 2017).

3.2.4 Trends in society and customer needs

Social and consumer needs are influencing transformation in education like never before. These transformations are a result of an increasingly interconnected society, the adoption of novel digital tools and improved behavioural science in comprehending the learning process (Gamper & Nothelfer, 2015).

3.2.4.1 Shifting role of educators

Lately, the pivot from teaching to facilitating has advanced the flipped learning phenomenon, resulting in students watching recorded lectures, videos and podcasts etc. from home. Even though there are challenges in terms of creating assessments that test mastery for students and student preparedness before attending class, there is a realisation that education should be bespoke to individual needs (Gamper & Nothelfer, 2015).

3.2.4.2 Continuous and lifelong learning movement

Lifelong learning involves all learning activities intended to improve knowledge and skills from a personal, civic and employment perspective. A longer life expectancy leaves people with more leisure time (Gamper & Nothelfer, 2015), with 25% needing adult learning for developing themselves, while 17% of individuals say it gives them pleasure (Doernyei, 2005). Universities must incorporate ongoing learning skills as part of their curriculum, or else their dominance of undergraduate programs is in jeopardy. Universities cannot afford be non-participants in continuous development, because portfolio careers and the gig economy require self-directed, affordable, accessible and just-in-time learning (EY, 2018).

"There is a need to retool yourself, and you should not expect to stop. People who do not spend five to 10 hours a week in online learning will obsolete themselves with the technology" (Stephenson, 2016). Online learning will simplify and make continuous learning elementary (Pozo-Olano, 2018). Non-degreed workers, people pursuing personal growth or those who want to refresh their skills can do so by continuing studies. Lifelong learning is now mainstream and tertiary education has to introduce programs for non-traditional learners (BCG, 2018). On top of helping a wide variety of lifelong learners, education technology will also develop educators who stay on top of the fast-changing field of education (Pozo-Olano, 2018).

3.2.4.3 Students as consumers of educational services

Today's students not only want to co-create the degree they will obtain, but also want to define the experience. For example, some want the ability to flexibly design their own major and electives. Universities therefore need to adapt to meet varying students' needs (BCG, 2018). When students are in charge of their learning, they can explore content that appeals to their curiosity, which frees educators to focus on facilitating and coaching (Pozo-Olano, 2018). It is very likely that by 2030 the course content will be less important than student experience, because consumption activities of the digital generation are leading to radical and diverse learning behaviours and expectations. A shift like this is expected, since virtually every consumer activity is shifting to web, mobile, social and visualisation technologies (EY, 2018).

3.2.4.4 Students as creators

Places of learning are now prioritising "value-added" learning by decreasing the focus on unidirectional instruction and increasing the focus on student-created content. This is possible through Web 2.0 platforms or makerspaces, which enable students to interact with and alter content with ease. Consumer and student creators will alleviate high education costs associated with creation, design and publication of educational content (Gamper & Nothelfer, 2015).

3.2.4.5 Democratisation of education and access

Democratisation of education was primarily a solution to improve access and opportunities by reducing school fees and material costs (Kiyao, 1981). However, in recent times, the emergency of digital and free content has created entirely new possibilities (Gamper & Nothelfer, 2015). Physically and philosophically, universities have traditionally been custodians of knowledge, but, due to technological connectivity, knowledge is now open to all citizens of the globe. Traditionally, access to universities was limited to 20-30% of the privileged, developed market of post-secondary students and a minute few elites in emerging markets (Ernst & Young [EY], 2012).

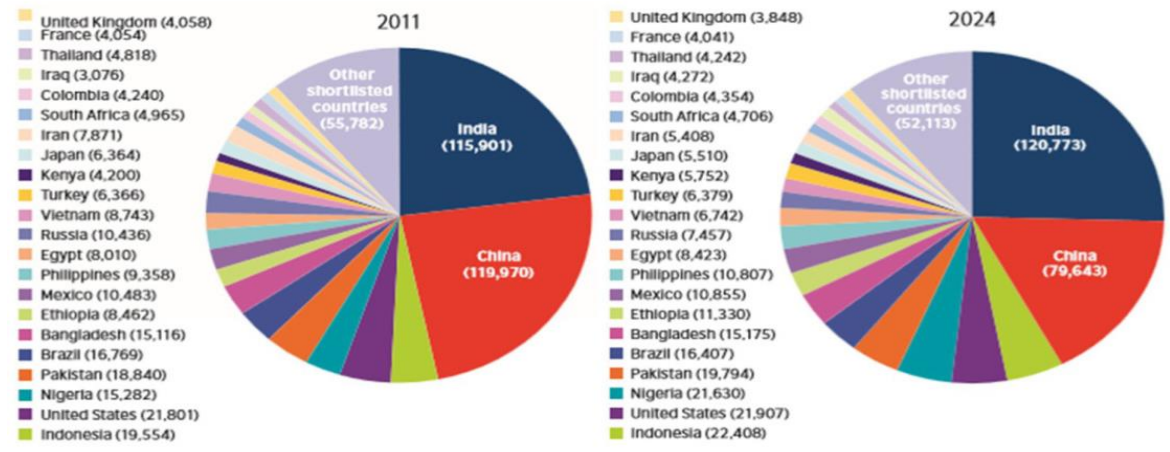
3.2.4.6 Increasing global competition

Global mobility will invariably increase for students and teaching staff, and even more so for university brands. The quest to create global brand impact and revenues have resulted in institutions like MIT, Harvard and so forth distributing their content across the globe (EY, 2012). Arizona State University free online courses attract students from about 200 countries (Pozo-Olano, 2018), as students are going after institutions that afford students experience of international exposure (BCG, 2018). The rivalry for global rankings, students and global knowledge hubs is turning the tertiary education landscape on its head. Student mobility is at its fastest as digital, political and socio-demographic alterations spur internationalisation as a strategic goal for many governments (EY, 2018).

3.2.4.7 Demographic shifts

On one side of the continuum, the aging rate in developed societies is unprecedented; on the other hand, there is increasing growth of younger populations in emerging economies, especially in India, Arab countries and North Africa. Additionally, there are issues with ballooning urbanisation, access to health care and education opportunities (British Council [BC], 2013). Around 2024, India, China, Indonesia and the United States will be home to 50% of the global 18-22 year-old population (see Figure 3.6). Outside of these four economies, the biggest increase will be in Africa (BC, 2013).

Figure 3.6: Global tertiary age (18-22) population (000s) 2011 and 2024



Source: Education Intelligence (2013)

3.3 WORKPLACE OF THE FUTURE

3.3.1 Changing world of work

The future of work will be radically different, driven largely by the in-the-machine economy, robotics and the reality that machine learning will take over repetitive tasks, changing the workplace. As the place of work metamorphoses, what is required for a graduate to be ready for future work also changes (EY, 2018). The risk of automation for employment and the prospect of entirely new lines of work and sectors should be considered (Bakhshi et al., 2017).

3.3.2 Artificial Intelligence and future jobs

Artificial Intelligence (AI) makes use of computer systems that have been designed to interact with the world as a human would, through capabilities like speech recognition and intelligent behaviours (Luckin, Holmes, Griffiths & Forcier, 2016). AI is synonymous with intelligent machines that function more or less like humans. Machine learning is an element of AI; it enables computers to learn in the absence of being programmed. Neural networks are a subset of AI that model the biological function of a man's brain in order to interpret and react to stimuli, for example, NUI's ability to recognise voices (Adams et al., 2017).

AI's contribution to global GDP will be up 14% in 2030, thus translating to $15.7 trillion. Gains will be in increased labour productivity and product enhancements, leading to increased consumer demand (Chainey, 2017). These gains will be predominant in China (26% uptick in GDP in 2030), followed by North America (with 14.5%), while emerging nations in Africa, Latin America and Asia will realise 5% (Chainey, 2017). According to PwC (2017), there are three levels of AI: assisted intelligence (GPS navigation), augmented intelligence (enabling carpooling) and autonomous intelligence (self-driving cars). All these will continue to create new economic activities and aid consumption, despite inevitably destroying some businesses.

Google's Deep Mind can learn on its own, without training, and it recently beat a human master at Go (Halal, Kolber & Davies, 2016). Without a doubt, humans are no longer indispensable. Several forecasts point to the elimination of almost 50% of existing jobs by 2025, leading to unprecedented unemployment (Rutkin, 2013). TechCast Global forecasts emerging technologies, social trends and wild cards so that strategists and decision-makers are furnished

with robust and relevant information. TechCast's 150 experts show an average error range of roughly +1/-3 years in the next decade (Halal, 2013). To ensure a balanced analysis, researchers often include opposing trends that hamper progress, such as political obstacles, spiralling costs or social resistance (Halal et al., 2016).

The category of complex manual jobs is expected to remain at 19% percent of workers in OECD countries (Rotman, 2015). Jobs like cleaners, barbers, janitors, agricultural workers, cooks, repair people and caregivers are hard to automate (Halal et al., 2016). Caregiving is somehow shielded from automation anxiety, because it relies on social skills and perceptiveness that is absent in machines (M&C, 2018). Currently, there is growth in child and elderly care jobs, therapy, personal trainers and career coaches (WEF, 2017d). Routine work like driving trucks, industrial and clerk work is at 35%. AI and machines will replace 30% of routine jobs by 2025 (TechCast Global, 2016). Service (knowledge) work is stable at 34%. This category of professional work, like educating, practising law, medicine and so on are likely to experience an upgrade and have new jobs created, as opposed to experiencing complete elimination (Bessen, 2016; Halal et al., 2016). Creative work is at a low 4%, but increasing. The "creative economy" is the future and is characterised by leadership, entrepreneurship, inventiveness, cooperation, foresight, etc. (Halal et al., 2016). Machines creativity is limited to exhaustive enumeration and evaluation of the underlying data, and not specifically from a spark of creativity (M&C, 2018). This category is not only hard to automate (Chui, 2015), but it is birthing new industries in the form of the Internet of Everything, smart homes, green economy, climate and energy control. Abstract tasks require personal interaction, versatility and problem-solving (Weisenthal, 2013).

3.3.3 Transitioning a new world of work

According to WEF (2017d), on a world scale, 4% of the population (employers) employ around 53% of the working-age population, 13% are self-employed, 7% are underemployed and 4% are unemployed. Additionally, one fifth of the population is inactive in the sense that they enter or re-enter the labour market, often characterised by unpaid work (WEF, 2017d). One of the biggest challenges in Africa will be to deliver quality jobs for the 15 to 20 million well-educated young people who enter the job market every year (WEF, 2017c).

Crowdsourcing talent will continue to rise since the extended talent pools are capable of acquiring new capabilities, flexibility in fluid situations, and cost efficiency (Christidis et al., 2017). Many factors of change have led to outsourcing, automation and independent contractors and, consequently, most nations and businesses are ill equipped to reskill and retrain blue-collar workers who have lost their jobs. At the same time, white-collar work is now also undergoing recalibration, requiring swift adaptation by both employees and managers (WEF, 2017d). On-demand online platform work exacerbates income inequalities between those who own the factors of production and those who do not (WSJ, 2016). In as much as "gig work" brings work life balance, flexibility and mobility, it comes with insecurity and uncertainty. For workers to be able to negotiate the new world of work, they need adaptability skills to take advantage of new opportunities and basic safety nets from the government (WEF, 2017d).

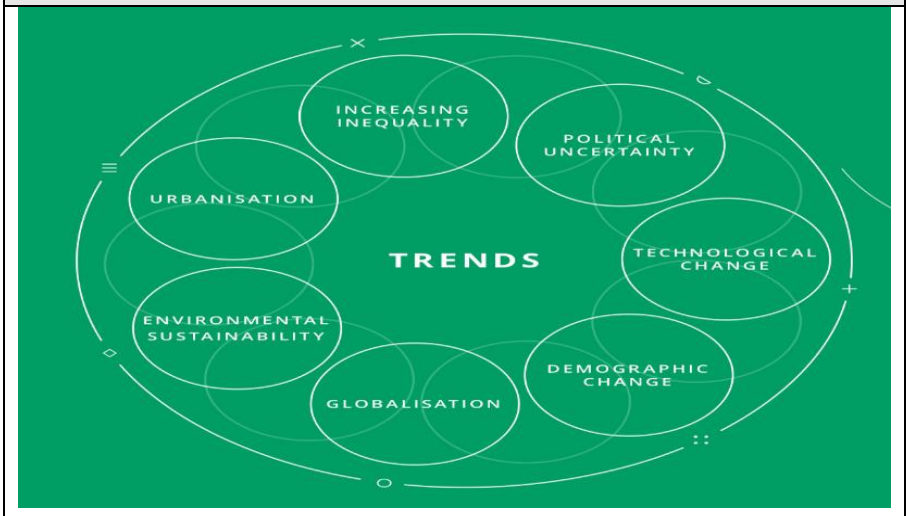
3.4 SKILLS OF THE FUTURE

The Future of Skills Report (2017) maps out the likely changes in employment, showing skills that will be in greater demand and predicting – with a good level of confidence – what kinds of modern jobs will be born (Bakhshi, Downing, Osborne & Schneider, 2017). The research methodology used in predicting future skills is robust, starting with studying industry structures and labour market trends, followed by foresight workshops. Machine learning classifiers then estimate skills that are likely to increase or decline (Bakhshi et al., 2017).

3.4.1 Trends affecting skills

Future work is by no means predicted on automation alone (see Figure 3.7). The emergence of the sustainability sector and green jobs are welcome, though at the mercy of political decisions. Urbanisation is a big driver, with more than 50% of the 8 billion people living in cities (and it will be 70% by 2050). Cities' attractiveness will lead to diverse employment and consumption opportunities. Globalisation is leading to the integration of labour markets, resulting in advanced manufacturing, unemployment and wage fluctuations, trade deficits and so on (Bakhshi et al., 2017).

Figure 3.7: Industry and labour market trends



Source: Pearson & Nesta (2017)

3.4.2 The future demand for occupations

Currently, 70% of people hold jobs that researchers are unsure will continue into the future. However, occupation redesign and reskilling of workers could save these jobs, and even grow them. Mainly low- to medium-skilled jobs will wind down, but not all jobs in this category will suffer the same fate (Bakhshi et al., 2017). For example, food and catering, elementary services and hospitality will be highly valued, because they are associated with differentiated products, even though they have lower skills requirements (Bakhshi et al., 2017).

Technology will usher new classes of work, some inconceivable, through today's lenses (Inayatullah, 2017). For example, amnesia surgeons will be endowed with skills to remove bad memories or destructive behaviour. Frey (2011) posits that 60% of the jobs in the next decade are yet to be invented, and hypothesises a list of jobs that will be most sought after in 2030 and beyond. The future jobs list includes: drone dispatchers, body part and limb makers, geo-engineers, mass energy storage developers and executioners for virus-builders, just to name a few (Frey, 2011).

In Great Britain, education, healthcare and public services are projected to see growth, incidentally in line with ageing masses and insatiable appetite for lifelong learning (Bakhshi et al., 2017). This is consistent with past research, which shows that public sector roles are

immune to mechanisation (Acemoglu & Restrepo, 2017). Creative, digital, design and engineering occupations should expect buoyant demand complementary of the technological revolution and growth in service markets. Additionally, designing structures and green jobs will gain from increased urbanisation and environmentalism (Bakhshi et al., 2017). Trending occupations in Africa include food technologists, 3D designers, big data specialists, education and health and care workers, and work in creativity (WEF, 2017c).

3.4.3 The future demand for skills

According to O*NET (2016), the US and the UK emphasises human skills, higher-order thinking skills (novelty, idea articulation) and systems skills (analysis, evaluation judgement). Human skills include teaching, social intelligence and coordination. These interpersonal qualities will only accelerate in importance as firms negotiate the trans-cultural landscape, punctuated with globalisation and digital technology (Tett, 2017). Findings from the future of skills report shows a correlation between higher-order thinking and future job demand. System thinking qualities include the ability to spot, comprehend and act on interdependent parts (Bakhshi et al., 2017).

"There is no future in any job. The future lies in the person who holds the job" Crane (as cited in Neubauer & Ghazali, 2016). Six in ten students are pursuing careers that will peter out; most of these young people will hold about 17 different jobs in their lifetime (Inayatullah, 2017). This is hardly shocking, because robots could do nearly half the activities in the workplace (Wright, 2016). As Adidas relocates manufacturing back to Germany, the Southeast Asian workers will suffer high unemployment due to cost effective robots (Hoskins, 2016). Soon economists will be anxious, worrying about a global dearth of robots (Sharma, 2016).

3.4.4 Global workforce demands

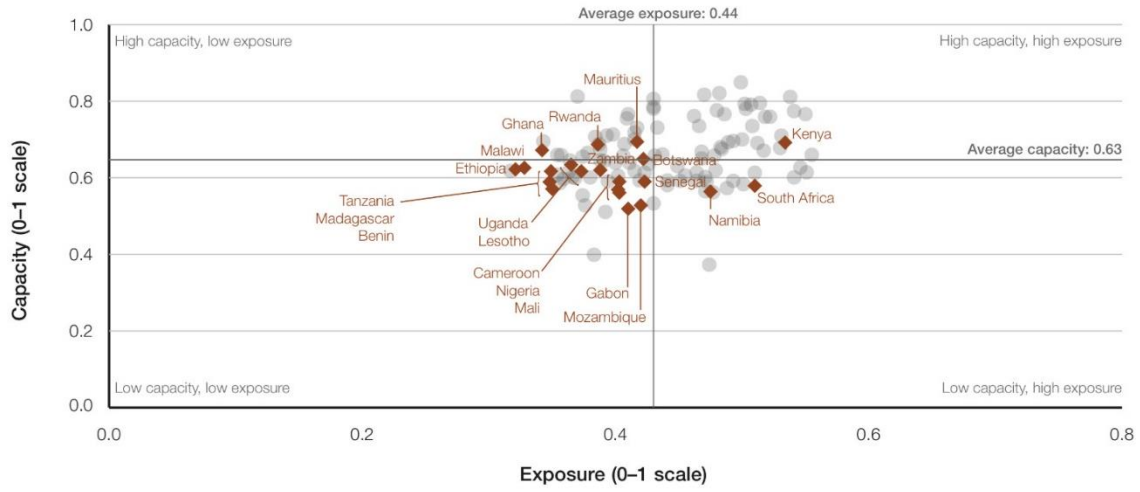
The industry is grappling with the scarcity of relevant skills and/or skills mismatch. The Hays Global Skills Index (2013) was crafted to examine the level to which employers will struggle to find suitable skilled labour. Education flexibility is one of the factors of the index measures, evaluating whether a nation's education system can adapt to cater for the needs of the future worker. Technological advancement raises the demand for skills, and investment in skills, and invariably affects the income disparity and employment across developed countries (Goldin &

Katz, 2009). The net effect is the decrease in routine tasks and an increased importance of higher order and non-routine manual tasks (Autor & Murnane (2003). Many emerging economies will struggle to close the gap, despite heavy investment, and this may be because education and business are not coordinating such that education cannot adapt (BC, 2013).

3.4.5 Preparing Africa for the Fourth Industrial Revolution

Forty-one percent of all South Africa's work activities are at risk because of automation, 44% in Ethiopia, 46% in Nigeria and 52% in Kenya. The region already struggles with finding suitably qualified personnel and the future is not rosy, as nearly 40% of core skills required across occupations will be completely new by 2020 in South Africa alone, where the average ICT intensity of jobs has gone up by 26% in the last 10 years (WEF, 2017c). Africa's susceptibility to technologically-driven labour market disruptions is mild – though it is accelerating – but that does not mean the call to reduce skills shortage is not urgent. If anything, Africa lags behind in its ability to adapt to the requirements of future jobs as measured by assessing the education quality and worker training initiatives, tertiary education attainment and breadth of skills. Figure 3.8 shows the region's exposure to disruptive emerging technologies, local economic diversification and complexity, worker efficiency and unemployment (WEF, 2017c).

Figure 3.8: Africa's capacity to adapt and exposure to the future of jobs



Source: WEF analysis (2017)

3.4.6 21st century skills

There is a realisation by many sectors that people need 21st century skills to fully function in future work settings (Luckin et al., 2016). Table 3.2 shows a list of 16 skills, split across three categories, put forward by WEF. The skills below have always been important and should be part of lifelong learning. Tertiary institutions of learning need to create trustworthy and valid metrics that can track learner progress on all the skills and capabilities in the knowledge and creative era. Additionally, there is an imperative to have a better understanding of the most effective teaching methodologies and the learning environments that create the required skills (Luckin et al., 2016).

Table 3.2: 21st century skills

Category	Helps students approach…	Related skills	
Foundational Literacies	…everyday tasks	Literacy Numeracy Scientific literacy Information communication	Technology literacy Financial literacy Cultural and civic literacy
Competencies	…complex challenges	Critical thinking and problem-solving	Communication Collaboration
Character Qualities	…changing environments	Curiosity Initiative Persistence/grit Adaptability	Leadership Social and cultural awareness

Source: WEF (2015)

The need for soft-skills like collaboration, decision-making, communication and planning means places of higher education must respond to meet the demand. Coursera is already incorporating soft-skills content in its courses (BCG, 2018).

3.4.7 Teaching skills for an AI future

Unlike in previous revolutions, AI is having a gigantic impact on many different fields: the production of data, better computing power and superior algorithms are at a faster speed than many organisations can react and adapt to (M&C, 2018). As AI matures, firms struggle to

recruit AI talent. The skills set has since moved from basic programming to competencies that require integration with other tools and complex problem-solving (Dooley, 2017). Hiring is likely to be focused in virtual agents, voice recognition, robotics, machine-learning and deep learning platforms, biometrics, natural language generation and processing (Forrester Research, 2017). A machine-learning engineer should possess natural language processing, computer vision and prediction skills (Dooley, 2017).

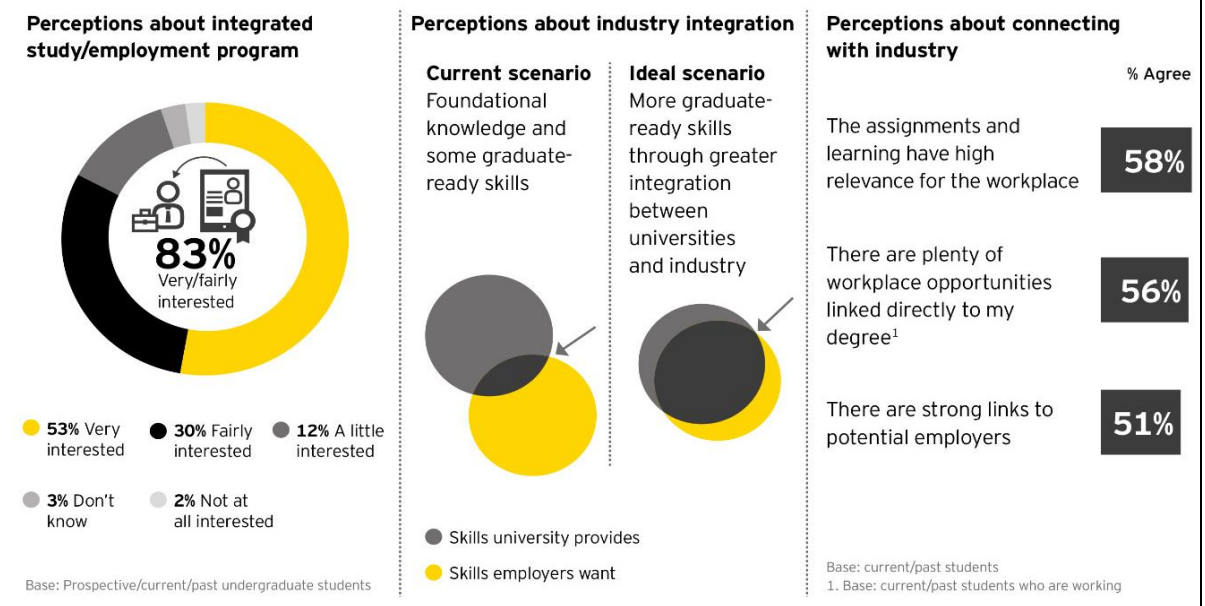
Thirty-five percent of AI jobs require a PhD, and 26 % require a master's degree (Paysa, 2017). Only PhD level expertise will be able to keep pace with the swift development of deep learning and machine-learning (Dooley, 2017). The demand for AI skills will continue to grow. Invariably, specific job requirements will have to be in line with courses and curricula aimed at developing AI specialties. Competition will embolden training specialists to develop curricula focused on next generation AI skills (Dooley, 2017).

3.4.8 Teaching and training for emerging industries

At the beginning of the 18th century, 200 000 people were employed in the clothes-washing business in the UK, compared to just 35 000 in 2011 (Crew, 2015). It is paramount that curricula focus on flexibility skills needed in emerging industries, so that students prepare for both new jobs and a world devoid of many traditional occupations. In other words, people require training to get along with their robots. The biggest challenge is not problem-solving, because technological devices can easily do that, but with defining problems and the awareness of how the complexity of problems keep changing. The ability to co-evolve with emergent technologies will be a core competency in this future (Inayatullah, 2017).

3.4.9 Integration with industry

Figure 3.9: Perceptions about university and industry collaboration



Source: EY Sweeney market research (2017)

A resounding 83% of undergraduate students showed interest in an integrated employment and education offering (EY, 2017). This is good news, as non-educational organisations are increasingly offering new educational services, blurring industry boundaries (EY, 2018). The synergy between industry and the tertiary sector is deepening. Industry is not only a customer and partner, but is slowly becoming a rival. If educational institutions are to survive and succeed, they need to strengthen the bond through industry-based learning and internships (EY, 2012). Technology disruption has recalibrated value chains and democratised information, yet this has brought about both opportunities and threats. New entrants are introducing new models, leading researchers to envisage the universities' ivory tower becoming the ivory network as industry players collaborate on research and innovation, curriculum design and work placements (EY, 2018). Universities need to do more than pure research; they need to collaborate with industry to create curricula that reflect what the world of work needs (EY, 2018). Universities must recognise that to solve major problems collaborative research is key. This is done by joining forces with the public, private and non-profit sectors (BCG, 2018).

3.5 TYPES OF EDUCATION

3.5.1 Technical and vocational education

Many countries have neglected technical and vocational education and training (TVET) over the years, but the FIR forces a fundamental paradigm shift, as quality TVET education can spur economic growth (WEF, 2017d). TVET trains workers for technical and skilled jobs in booming areas, such as building, health and wellness, and advanced production. There should be a balance between tailoring TVET programmes to tackle local employer needs and making sure that TVET provisions meet the strategic vision for the local economy (OECD, 2016b).

According to World Development Indicators (2015), skills mismatch arises from the challenges of education relevance and quality, incoherent links between skills training and industry, and poor perception of TVET, leading to their neglect. In many Sub-Saharan African (SSA) countries, good TVET institutions are unavailable, and those who progress from TVET have limited opportunities because of lack of prestige in TVET certification (Boateng and Baffour, 2015). To put SSA on the road to economic recovery and reverse the declining skills trend requires a number of policy and program changes. A future-ready TVET education ecosystem needs:

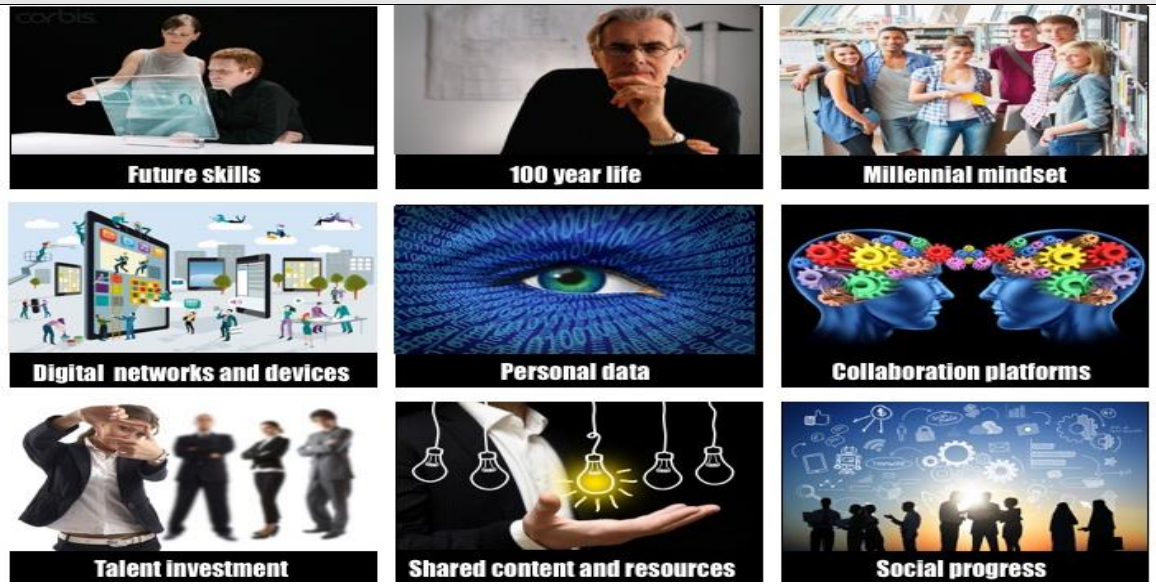
- Improved accessibility to recent and quality TVET study and qualifications.
- Ensured continued relevance of skills through agreed industry standards based on continuous certification and credentialing systems.
- Improved prestige of TVET as a viable education qualification among learners, employers and other stakeholders. (WEF, 2017d)

TVET and apprenticeship systems require agility and flexibility when it comes reacting to changes in labour market needs and technologically induced workplace restructuring. An attitude of lifelong learning and skills acquisition requires greater emphasis on learning by doing, teamwork and the need for valid assessment methods to ensure recognisability of competencies by employers (OECD, 2016b).

In Germany, half a million company-based training contracts are provided each year. In a 2-3-year apprenticeship, apprentices spend a day or two in class and 3-4 days a week mastering practical skills at a company. This is also helpful for learning work habits and absorbing the company culture. The Swiss TVET system takes 3-4 years of training and classroom instruction. Work time is paid and, after graduation, apprentices can earn a university degree or further certifications (lifelong learning). The government, in partnership with the private sector, defines curricula and skill sets, and sets standards for occupations across Switzerland (WEF, 2017d).

3.5.2 Education 4.0

Figure 3.10: Drivers of Education 4.0



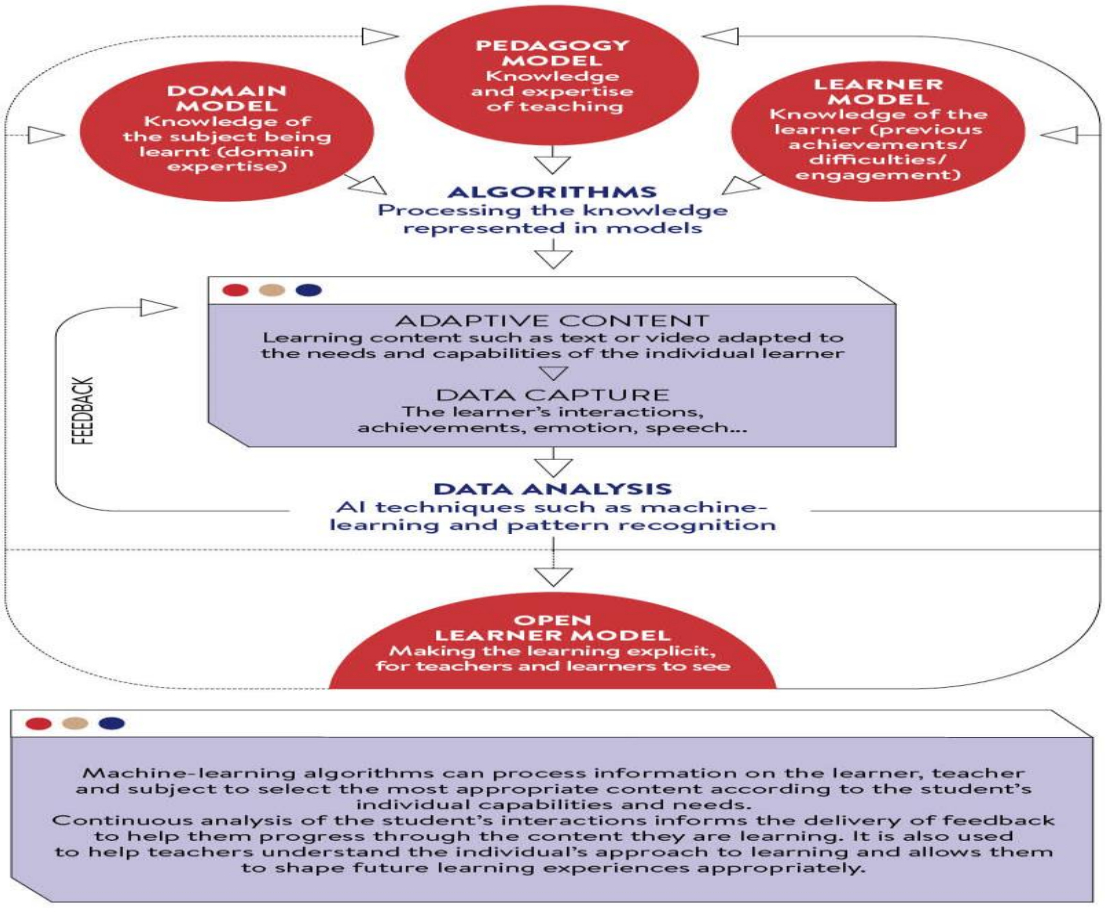
Source: Fisk (2017)

Figure 3.10 shows the elements driving Education 4.0. Fisk (2017) describes Education 4.0 as "modular and projects, practical application, peers and mentors, anywhere anytime, personal, flexible delivery, evaluated but not examined." In order to adapt to the future gig economy, learners will have to adapt to project-based learning and, in the process, acquire cooperation, organisational and time management competencies. A future-ready education means curricula will accommodate internships and mentoring projects so that students can acquire real-world skills that mirror their future field of work (field experience). When machines take over every statistical computation and analysis, humans' roles will shift to the interpretation of data, application of theoretical knowledge to numbers and making cognitive inferences. Lastly,

today's examination system will become redundant, because 'question and answer' will not suffice to measure the soft skills. A true reflection of what a student knows should be tested when the student is applying knowledge to a project in the field (Fisk, 2017).

3.5.3 Artificial Intelligence in Education (AIEd)

Figure 3.11: AIEd system with an adaptive tutor



Source: Pearson 2016

AIEd offers a deeper and more detailed understanding of how learning occurs (Luckin et al., 2016). AI relies on knowledge about the world and algorithms to process that knowledge in an intelligent way. The knowledge is classified as the pedagogical model (teaching method), domain model (learning subject) and learner model (student interaction with machine). The domain and pedagogy can use interactions in the model, like current activities or emotional state, to make inferences about success or failure (Luckin et al., 2016). Crucially, there is incessant feedback to make learning richer and thorough as described in Figure 3.11.

3.5.3.1 The future of AIEd

AI is very promising in education, mainly because it can up productivity and engagement, and has the ability to simplify the lives of the global workforce (Adams et al., 2017). Woolf, et al. (2013) suggests that AI can help address educational issues by providing: lifelong and life-wide technologies; access to global classrooms; individual virtual mentors for each student; analysis of interaction data; and the ability to address the knowledge economy skills (Kurshan, 2016).

AI has been a game changer in learning through voice recognition, rationalising, planning and cognitive modelling (Woolf, 2009). One-to-one human tutoring is regarded as the best teaching and learning methodology, but there are not enough teachers to make it possible (Luckin et al., 2016). *Intelligent Tutor Systems* (ITS) can track the "mental steps" of students while they are engaged in problem-solving tasks to detect misconceptions and gauge their understanding. The guidance, feedback and relevant level learning activity prescriptions will help facilitate self-regulation, self-monitoring and self-explanation (Azevedo & Hadwin, 2005; Shute, 2008; Van Lehn, 2006; Kurshan, 2016).

Even though humanoid robot teachers will not be in the classroom within the next ten years, AI will continue to redefine education (TeachThought, 2017). The result of AI not replacing teachers is that educators' time will be used more effectively and efficiently (Luckin et al., 2016). Machine learning is useful in identifying precisely where students are struggling or where there has been improper explanation of the content (M&C, 2018). The use of analytics to predict when a student is likely to fail an assessment or unlikely to complete their studies have gained momentum due to improved accuracy. Learning analytics are able to identify changes in learner confidence and motivation while learning a foreign language, for example (Luckin et al., 2016). AI can revolutionise who teaches and supports (AI tutors), where teaching happens and how learners acquire basic skills (TeachThought, 2017).

3.5.3.2 Education and technology race

Little attention has been paid to the implication of machines for learning, partly because quantitative researchers have focused mainly on job categories as opposed to skills. As if that was not enough, there is a bias towards roles likely to be mechanised, relative to those likely

to be created. This could change if educators, rather than economists, are leading the debate. It is time people realise that humans can live and work alongside intelligent machines, and the education systems will need prepare students for the future economy and achieve at unprecedented levels (Luckin et al., 2016). Table 3.3 below shows the mapping of AIEd tools parallel to the likely requirements of the jobs market in 15 years' time.

Table 3.3: Reforming education through AIEd

In 15 years time...	The implication for learning...	How AIEd can help...
Many of the new jobs created will be much more cognitively demanding than those currently available	Students will need to learn as efficiently and effectively as possible	Give every learner their own personal tutor, in every subject
		Provide every teacher with their own AI teaching assistant
		AIEd to deliver timely, smarter, teacher professional development
		AIEd tools that help every parent support their child's learning
	We will need to seriously attend to the non-cognitive factors that influence learning – grit, tenacity and perseverance; affect; 'mindset'	AIEd tools that embody new insights from neuroscience or psychology
		Making available new insights into how learning is going for an individual and the factors that make it more likely to occur
		In light of that, providing the right support, at the right time, to keep learning on track
	Students will need to achieve higher-order skills – e.g. problem solving – alongside 'knowing what'	Intelligent Virtual Reality to allow learners to be supported to learn in authentic environments – and to transfer that learning back to the real world
Social skills will be where humans continue to excel	Students need to be effective collaborative problem solvers and makers, able to build on others' ideas and extend and sensitively critique an argument	Intelligent support for collaborative learning
	The ability to get on with others, to empathise and create a human connection, will continue to be valued	AIEd techniques to help us understand better how to deliver a wider variety of attributes, and how well a learner is acquiring them
We will need to re-skill large parts of the current workforce – in essence, creating a learning society	We will need new ways of equipping adult learners with new skills – more frequently, quickly, and effectively	AIEd tools that support learners to become effective, self-regulated learners for lifelong learning
		Lifelong learning companions to advise, recommend, and track learning
		More flexible learning environments, allowing learners to learn at a time and a place that works best for them

Source: Pearson 2016

3.5.4 Education for Sustainable Development

A sustainable learning institution caters for Education for Sustainable Development (ESD). ESD leads to students acquiring the values, knowledge and skills required to shape their own way of life and society in a sustainable way (Dannenberg & Grapentin, 2016). Advancing policy can anchor ESD in curricula and quality standards, causing systemic changes (UNESCO, 2014). Yet according to Dannenberg & Grapentin (2016), it is not simply about a content-related focus on ESD, but about setting an example and practicing sustainability in order to facilitate the transfer into everyday life.

Tertiary education institutions can choose ESD as a prospective strategy and focus on competencies needed to transform social relations, the economy and the management of natural resources under conditions of uncertainty (Dannenberg & Grapentin, 2016). Sustainable education is future-oriented and focuses on competencies that are crucial for understanding the key challenges of the society (Rieckmann, 2012). Once the competencies are part of university or college settings, they can be measured as the aspired outcomes of education, which will be used to solve problems in the future fields of work. In effect, the ESD mandate challenges all forms of educational provision to adopt practices and approaches that foster the values of Sustainable Development (UNESCO, 2005).

Environmentally oriented universities prioritise environmental sustainability through tackling, among other factors, rising temperatures, water and sanitation, land abuse, sustainable agriculture, pollution, landfills, biodiversity, disaster alleviation, smart energy and efficient transport (Beynaghi et al., 2015). A "socially engaged university" co-creates with the stakeholders in the community to change the society by pursuing social well-being through education, research and outreach. At its core is tackling inequality, human development, empowerment of women, wellness, food security etc. (Horrigan, 2014; Whitmer et al., 2010; Beynaghi et al., 2015). Economically focused institutions, such as MIT and Stanford, are expected to align their goals with economic development and entrepreneurialism, hence the term, "entrepreneurial university" (Etzkowitz, 2002). There is a correlation between entrepreneurship skills and imaginative skills and these entrepreneurship competencies have been integrated into all levels of education in many of the OECD countries (Hytti and O'Gorman, 2004; OECD, 2016c).

3.6 CONCLUSION

This chapter reviewed the challenges and megatrends affecting the tertiary education market. This was done so that leaders of tertiary institutions might be able to accommodate the learner of the future, also ensuring the survival of their institutions in light of the disruptive technologies. Additionally, this section looked at the impact of the drivers of change, including the changes in the workplace and the skills that will be required in the future as education, governments and citizens adapt to change. The next chapter will detail the Six Pillars of Futures Studies, with particular attention to CLA, scenario planning and other relevant concepts in line with the future of tertiary education in South Africa.

CHAPTER 4

THE SIX PILLARS OF FUTURES STUDIES

4.1 INTRODUCTION

This chapter addresses research questions Q5 and Q6 and research objectives O3, O4, O5. The previous chapter outlined the drivers of change in the education sector – these trends will facilitate the designing of possible scenarios in the tertiary education sector. Therefore, the trends that shape the future of education will be summarised as a precursor to **Pillar 2** to **Pillar 4**. The Causal Layered Analysis (CLA) will take centre stage in an effort to deepen the understanding of South African tertiary education, reveal underlying assumptions and eventually provide a window into possible futures for skills transformation.

In the article, "Dancing with Systems", Meadows (2002) talks about the power of envisioning the future and bringing it into existence. The future cannot be predicted, but – without imposing one's will upon a system – one can pay attention to what the system is saying. One can then uncover how the system's properties and our values collaborate to form something much better than could ever be produced by one's will alone. In fact, one cannot control systems, but it is possible to configure and reconfigure systems (Meadows, 2002). Systems thinking has created a variety of principles and tools for analysing and transforming systems (Inayatullah, 2013).

Foresight is a difficult practice (Inayatullah, 2018). According to Dator (2002), foresight "is an unnatural act". Studies by Dunagan (2016) from Brain Science show that when the mind searches for the future, it sees the past. As Dator (2009) argues, "our brain is constantly anticipating what is about to happen, and comparing its expectation with reality in order to improve subsequent forecasts". Whether our brains counter the future, or predict it, without a doubt, the meticulous use of Futures Studies methods and tools can be substantive (Inayatullah, 2018).

Confidence in Futures Studies as a conceptual framework or foresight methodology has been low in the past, but recent frameworks have been developed with dynamic theory and practice at their foundation, including Voros' Common Foresight Method framework and the Six Pillars approach (Inayatullah, 2010). However, foresight is much harder to achieve now than ever

before, owing to the speed and complexity change (World Future Society, 2004). Forecasts and visions are inherently epistemological undertakings, because they are based on some theory of knowledge. Ironically, they do not result in knowledge of the future itself. Therefore, they only furnish us with manufactured knowledge of a restricted number of possibilities (Sardar, 2010).

Futures Studies principles can help educationists and policymakers think more thoroughly and master practical foresight, or "insight into how and why the future will be different than today" (Lum, 2016, p. 7; Bengston, 2017). Using futures methods improves anticipatory consciousness, which consequently enhances the foresight to develop strategies and new opportunities more quickly, and makes it easier for a firm to deal with change (Glenn, 2009). The Six Pillars of Futures Studies is used as futures thinking theory to guide the process of mapping, anticipation, timing, deepening, creating alternatives and transforming the future (Inayatullah, 2008).

4.2 MAPPING THE FUTURE

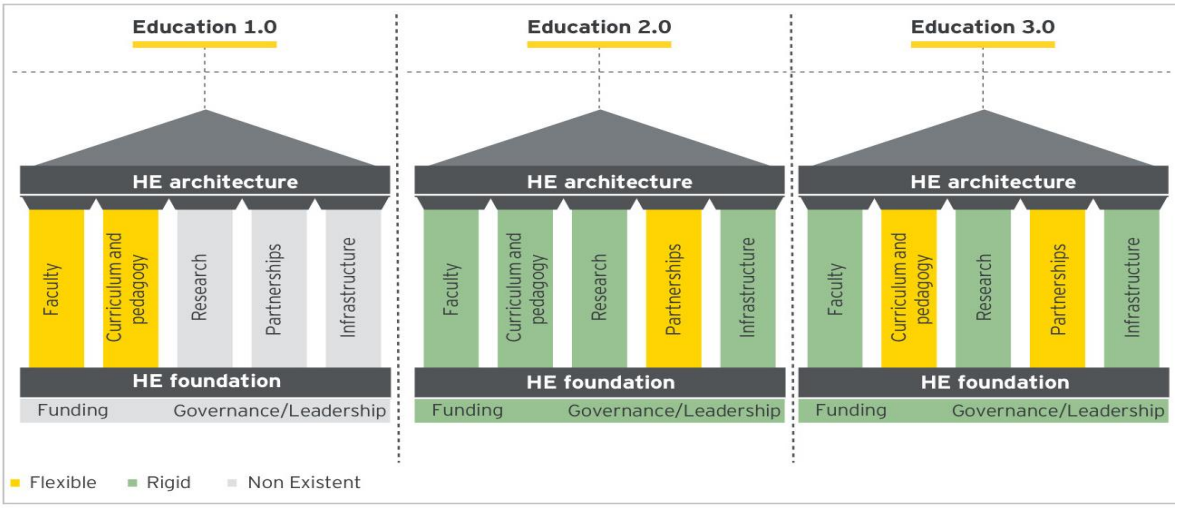
The first pillar maps the history, the present and the future so that people can have an indication of how far the human race has come and where humanity is going (Inayatullah, 2008). Having a "shared history" is valuable, because it does not only show how the megatrends gave rise to the present, but also where there has been continuity or discontinuity from the past. Equally important is the fact that shared history distinguishes between slow, stable, abrupt or disruptive change (Inayatullah, 2008; Gray & Hovav, 2011). Analysis refers to looking at knowledge from the past viewpoint, while knowledge referring to the future is called, "foresight" (Oner & Oner, 2003).

4.2.1 Education 1.0 to Education 3.0

Figure 4.1 shows the transition through different types of education. Ancient education was tailored to suit only elite boys, and became popular after the introduction of informal education in India, China, Israel, Rome and Greece. In the Middle Ages, the dominance of religion in Western Europe and India, and Rome's scientific research focus, changed education. The invention of the printing press increased access to basic education for the masses and brought in a culture of scientific inquiry. Socio-economic advances led to Education 2.0, which took several millennia to metamorphose from the traditional Education 1.0. There was an uptick in

vocational education in parts of Asia and Europe through apprenticeships and monasteries, including new age scholars who focused on management. Education 2.0 proliferation coincided with the establishment of several universities toward the end of the 18th century (EY, 2017).

Figure 4.1: Progression of education



	Faculty	Curriculum and pedagogy	Research	Partnerships	Infrastructure	Funding	Governance/ Leadership
Education 1.0	Priests and religious figures No qualification requirements	Unstructured and undocumented, Person to Person	Limited to debate on religion and social aspects	Limited to the co-religionists, and segregated by kingdom boundaries	Adjacent to religious regions, in gurukul, church, or mosque – with strong connects with the society	Supported by religious donations and support from monarchies	Social monitoring through the court of the kings Informal hierarchy among faculty based on religious seniority
Education 2.0	Full-time career teachers Rigid educational qualification requirements	Structured and rigid in class teaching One-to-many mass teaching systems with a fixed curriculum	Strong research systems in scientific and social sciences	Limited to the country or region	Evolution of university campus - large physical spaces with study halls, residences and recreation areas	Evolution of fee-based funding and government support for public institutions Research and endowments growth for old institutions	Advent of country-level regulators Definition of institute governance systems and rigid hierarchy
Education 3.0	Full-time career teachers Rigid educational qualification requirements	Rigid curriculum but some flexibility through online modes of learning	Transition toward collaborative research using technology	Growth in partnerships due to enhancements in telecommunications	Some investments in technology infrastructure in addition to the physical campus based infrastructure	Fee-based funding systems	Move toward accreditation in addition to firm regulations

Source: EY (2017)

The movement to Education 3.0 took a couple of decades (EY, 2017). The emergence of the internet and IT resulted in increased accessibility to tertiary education. The transition toward

platform-enabled learning drove exponential growth in the education technology market, but the core learning methods have remained unchanged (EY, 2017). Incidentally, with changing skills and changing workforce, the global Edtech market is projected to reach US$94 billion in 2020, from US$43 billion in 2015 (Global Forecast to 2020, 2016).

4.2.2 Trends affecting education

This research will attempt to recognise the key trends and happenings leading up to the present. This is so as to build a historical timeline to the present, to ascertain the connections and discontinuations in the history of education (see Table 4.1).

Table 4.1: Summary of global trends

Source	Trends
WEF	FIR; ageing population; continued learning; workforce reskilling; future of jobs; flexible work; cloud technology; sharing economy; IoT; future-ready strategies; digital fluency; openness to education innovation
NMC	Deeper learning; measuring learning; redesigning spaces; collaborative learning; blended learning; online evolution; ubiquity of social media; cross-institution collaboration; students as creators; ubiquitous learning
Mckinsey & Co	Automation; demand for soft priorities; student mind-sets; common accreditation standards; new skills; transparency around outcomes; AI; future workplace/workforce; work-based learning; societal changes
TeachThought	Growth mind-set; digital citizenship; robotics; gamification; adaptive learning algorithms; constructive struggling; internationalisation; TED-Ed; disrupting innovation; MOOC; vocational training; global view
British Council	Cultural impact; global workforce demand; digital technology; changes to political conditions; economic dynamics; demographic shifts; growth of non-institutional providers; the evolution of MOOCS
Ernst & Young	Democratisation of knowledge; contestability of markets and funding; job-hopping; global mobility; integration with industry; increasing international competition; rise of continuous learning; social changes

Source: WEF (2016, 2017); NMC (2017); McKinsey & Company (2016, 2017, 2018); TeachThought (2018); British Council (2013); EY (2012, 2016, 2017)

This research study acquired from a global perspective the megatrends affecting education now without making an effort to picture what it could look like in the future or how it could get there. The drivers of change discussed in Chapter 3 represent a detailed Environmental Scan (ES) of the tertiary education sector that affects its future. According to Puglisi (2001), the purpose of environmental scanning is to generate information that can be used for the development of scenarios. ES reveals early clues and "weak signals" precipitating any emerging alternative futures (Glenn & Gordon, 2009). The process of "selecting our future often requires having a handle on the possibilities of the future" (du Plessis, 2016).

According to Kreibich (2011), drivers of change are certain forces, factors and uncertainties that are in stakeholders' hands, which facilitate or usher in change in the micro environment or the institutional environment. Trends are critical, because they link the past and the future, facilitating the processing of information about what has happened in the past into knowledge about what might happen in the future (du Plessis, 2016). It would be folly for educational futures to focus solely on external "trends", such as globalisation, global risks, commerce and so on, without looking at the knowledge paradigm shifts that have been occurring. The "megatrends of the mind" are equally vital for tertiary education futures, as the drivers of change in the external world (Gidley, 2010).

4.3 ANTICIPATING THE FUTURE

The second pillar uses emerging issues analysis as its core method of anticipating the future. The aim is to frustrate the map and perceive improbable and hidden issues that could provoke how the future is being understood (Inayatullah, 2017). Anticipation endeavours to conjure the possible trajectory of current problems, including imagining what future these issues might create (Gould, 2008). At best, anticipating the future primarily pinpoints issues before they are out of control and costly. Simultaneously, it pursues new opportunities and possibilities, while also considering emerging issues that may possibly include disrupters (Inayatullah, 2008). This means making sense of the data produced by the mapping pillar, through the analysis of emerging issues, to detect areas in which new social innovation arises (Inayatullah, 2008). Emerging Issues Analysis (EIA) takes the eyes off the current problems to the identification of trends and emerging issues shaping the future (Gould, 2008). Thus, it tries to pre-empt issues before they become known (Molitor, 1977). These issues, if unchecked, may transmogrify into

undesirable trends, which in turn might develop into a probable scenario for the future (Gould, 2008; Inayatullah, 2008).

Disruptors that arise as emerging issues tend to question the status quo or seek for novel opportunities. The questions may include:

- Is university architecture going to reflect future workplace designs or climate change?
- Will places of learning ban meat and soft drinks?
- Are robots going to replace teachers, and will they be granted legal rights?
- Will there be liberty to learn anything without restrictions?
- Will experiential VR-based learning and practical-based education be ubiquitous?
- Will skills transformation result in corporate takeover of universities?
- Is mindfulness going to be in the curriculum? (Molitor, 2003; Sheraz & Beg, 2015)

Many disruptors could be a source of contention later in the future. These include: social and religious resistance to change, educated youth mental issues, collision of cultures, technology addiction, xenophobia/populism and a focus on well-being (Sheraz & Beg, 2015). Other issues found in literature include: the challenges of implementing higher standards, dwindling government financial support, teacher evaluation and monitoring changes (Daggett, 2014).

The interplay of the disruptors with the greatest effect and highest uncertainty can be used to configure scenarios (Sheraz & Beg, 2015). Usually, in a futures workshop, participants will have to imagine what the future of the issues at hand would turn out to be. Additionally, they will envision the future they are afraid of. For example, people may fear non-universities, new models of learning, globalised accreditation systems or that home-based education would be prevalent for higher order learning (Sheraz & Beg, 2015). The myopic focus on disruption by EIA, which solely identifies hype cycle new technologies, means that non-superficial understanding is needed (Inayatullah, 2017).

Trying to manage issues before they become problematic in the future is why EIA is important (Gould, 2008); it will facilitate answers to rudimental questions that are crucial to the creation of foresight (du Plessis, 2016). In this study, such questions include:

- What does skills transformation mean for the tertiary education in South Africa?

- What are the concerns that could challenge the realisation of the future of South Africa's tertiary education sector?

4.3.1 Skills revolution

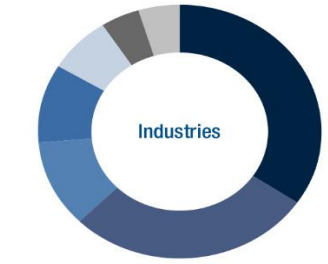
Christidis (2017) argues that the skills profile of the future is more about "interacting" with technology, as opposed to "using" technology. In other words, competitive advantage will lie in human skills, and technical skills will be the means by which to compete. Research involving tertiary-educated employees reveals that the prerequisite of innovation is more than just STEM literacy, but a broad range of skills. Chief among them are creativity, lateral thinking and interpersonal skills (OECD, 2016c). The complexity of the present and future world makes it incumbent to possess certain skills in order to circumvent unexpected future challenges. Key drivers and challenges inform the competencies and skills that workers of the future need to develop. The evolving sophistication of technology and other environmental drivers must also be taken into account when imagining the future of 21st century learning (Scott, 2015; Davies & Fidler, 2011; Leadbeater & Wong, 2010; Redecker, 2011). Future employers and skills providers will need to know the skills, size and shape of the future workforce, thus this research will provide scenarios that will consider different drivers to envision and deliver the future workforce.

The legacy of apartheid continues to shape the South African labour force, resulting in twin contemporary challenges: to boost the skills and capability levels of workers and tame the spiralling unemployment rate (Reddy, 2016). "SA has set itself the goals of eradicating poverty, reducing inequality, growing the economy by an average of 5,4%, and cutting the unemployment rate to 6% by 2030" (NDP, 2015, p. 296-297). NDP Vision 2030 sees skills development through critical education, training and innovation as vital to the achievement of these goals. If Sub-Saharan Africa is to realise an optimistic vision of the future of jobs, the focus should not be only on developing the skills needed today, but also on skills needed to successfully leverage the technological advances of tomorrow (WEF, 2017c).

4.3.2 Describing South Africa

Figure 4.2: South Africa profile

Sample Overview



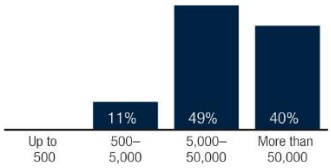
- Financial Services & Investors 35%
- Basic and Infrastructure 28%
- Information and Communication Technology 11%
- Mobility 10%
- Professional Services 7%
- Consumer 5%
- Others 5%

Workforce Disruption

Main Industries

Industry	Employment outlook, 2015–2020	CURRENT: Local share of recruitment, specialists	CURRENT: Ease of recruitment, overall	2020: Local share of recruitment, specialists	2020: Ease of recruitment, overall
Financial Services & Investors	growth 1.25%	76–100%	hard	51–75%	neutral
Basic and Infrastructure	decline –3.79%	51–75%	hard	51–75%	harder
Information and Communication Technology	decline –3.75%	76–100%	hard	76–100%	neutral
Mobility	growth 2.78%	76–100%	hard	—	harder
Professional Services	decline –1.25%	—	easy	—	harder
Consumer	decline –2.00%	—	neutral	—	neutral

Number of Employees



Ease of Recruitment

Occupation types	CURRENT: Country/region	CURRENT: Sample average	2020: Country/region	2020: Sample average
Mass Employment — Assembly and Factory Workers	hard	hard	neutral	neutral
Strategic/Specialist — Sales and Marketing Professionals	hard	hard	neutral	harder
New and Emerging — Data Analysts	—	—	very hard	hard

Source: WEF (2016)

Figure 4.2 shows the general makeup of the South African economic sector and the likely changes due to disruption leading up to 2020. With many sectors already experiencing recruitment challenges, it suggests a particular skills mismatch, skills obsolescence or skills deficit (Grapsa, 2017). NDP (2015) findings reveal that the education system is not adequately serving skills development; it is in dire need of transformation. Information from forecasts on current and future skills needed by the economy can be used to plan the size and shape of the post-school education and training system (Grapsa, 2017). "Improving the quality of education outcomes throughout the education system is one of the highest priorities over the next 18 years, and beyond" (NDP, 2015, p. 133).

With an unemployment rate of 27% (StatsSA, 2016), only 15 million South Africans are in employment (Reddy, 2016). According to the NDP (2015), the government wants to nearly double employment from 13 million in 2010 to 24 million in 2030, and scale per capita income

from R50 000 in 2010 to R120 000 by 2030. 20% of people in employment possess tertiary qualifications and 32% have completed secondary education. Owing to these differentiated educational levels and diverse age groups, there must be multiple skills policy responses to increase skills qualifications of the workforce (Reddy, 2016). The situation is exacerbated by that fact that the quality of education in South Africa differs greatly among educational institutions, which might cripple workers from disadvantaged backgrounds with a deficiency of skills. Consequently, a concerted effort for quality education for all is a priority (Grapsa, 2017).

4.3.3 Key trends in skills supply and demand in South Africa

The realities and challenges facing the country should determine the skills planning approach. In the South African context, the National Planning Commission (NPC, 2011) asserts that "the triple challenges of poverty, inequality and unemployment" should best inform policy. Given that the labour market is generating unabatingly high levels of both inequality and poverty, access to skills valued in the labour market is now more vital than ever before. This requires that the PSET sector should provide excellent quality education, which will improve skills for the workplace and thereby stimulate productivity and remuneration of players in the labour market (Department of Higher Education and Training [DHET], 2018). Skills mismatch (see Table 4.2) raises doubts about the ability of economies to capitalise on their workforces (WEF, 2014).

Table 4.2: Forms of skills mismatch

Skill shortage	Demand for a particular type of skill exceeds the supply of people with that skill at equilibrium rates of pay.
Qualification mismatch	The level of qualification and/or the field of qualification is different from that required to perform the job adequately.
Over-(Under-) qualification/ education	The level of qualification/education is higher (lower) than required to perform the job adequately.
Skill gap	The type or level of skills is different from that required to perform the job adequately.
Over-(Under-) skilling	The level of skill is higher (lower) than required to adequately perform the job.

Source: Cedefop (2010); OECD (2011)

At the macroeconomic level, skills mismatch leads to structural unemployment and lowers growth in GDP through workforce underutilisation and a decrease in productivity (WEF,

2014). Over-education comes with lower wages, lower returns on investment in education and less satisfaction at work. On the other hand, under-qualified employees are less productive, and susceptible to losing their jobs (Grapsa, 2017). By 2030, the NDP (2015) envisages an education system with "an expanding higher-education sector that can contribute to rising incomes, higher productivity and the shift to a more knowledge-intensive economy". Besides educational mismatch, South Africa grapples with skills mismatch, which manifests in skills underutilisation (an employee having more skills than the job requires) or skills deficit (an employee's skills do not meet the requirements for the job) (Grapsa, 2017). Skills mismatch may be a superior predictor for training participation and job satisfaction than educational mismatch. This offers hope, given the massive inequality in the South African labour market in terms of both remuneration and access to education and training (Grapsa, 2017).

According to Reddy et al. (2016), South Africa's skills landscape is shaped by:

- Low economic growth rates, leading to poor employment growth.
- Structural mismatch between labour demand and supply, which hampers viable job creation.
- The workforce's education level and skill base being lower than many productive economies.
- Poor quality education, despite improved access to schools, universities, and TVET colleges.
- 30% of employed individuals being overqualified (LMIP, 2016 – based on SASA Survey).
- The massification and internationalisation of Higher Education (Mabelebele, 2015).
- The decline in state funding and return on investment discourse (Mabelebele, 2015).
- The green economy's impact on jobs (Borel-Saladin & Turok, 2013).

4.3.4 Future jobs

The FIR is engaging socio-economic and demographic factors to cause major disruptions to labour markets, including developing new business models, growing new jobs, changing ways of organising and coordinating work, and demanding new skills sets (WEF, 2017c). Automation will have a three-pronged effect in terms of jobs lost, occupations changed and work gained. The ripple effects will take the form of changing occupations, new skills profiles

and transforming educational prerequisites (M&C, 2017). The notion of machines usurping humans is not substantiated by history or data. Contrary to popular opinion, it will not be jobs that will be scarce in the future, but a shortage of skills to fill those jobs (Kasriel, 2017). It is likely that every company will become a technology company in the future, and competing without software is "like competing without electricity" (Ravikant, 2017).

The digital disruption is not only assaulting companies, but individuals within companies, as the days when an army of IT specialists would run systems are gone. Currently, a company needs an army of data scientists (Merrington, 2017). The most common emerging job category across all industries and geographies is that of data analyst, who will be able to derive insights from the avalanche of data generated by the technological disruptions. Equally popular is the role of specialised sales representative, as the need to commercialise and explain offerings to clients and consumers will increase, due to the innovative technical nature of the products (WEF, 2016). Technology is turning the business model upside down and invariably changing the skills needed. The top ten skills in South Africa, predicated on a LinkedIn survey, are all technology related. The top five in order of importance are: statistical analysis and data mining, java development, middleware and integration software, mobile development, and network and information security (Merrington, 2017).

WEF (2016) introduced a new metric known as skills stability to measure the degree of skills disruption within a job, a job family or an entire industry. There is a need for more talent in some job categories, resulting in high skills instability. To prevent a worst-case scenario characterised by talent shortages, mass unemployment and growing inequality, reskilling and upskilling of today's workers is mandatory (WEF, 2016). To cement a robust supply of future skills, Africa's educators should begin by encouraging critical thinking, creativity, cognitive flexibility and emotional intelligence, in lieu of regurgitation learning, to reflect collaboration and new way of working (WEF, 2017c). History is littered with countries that have optimally ridden the wave of technological change by investing in their workers and adapting policies, institutions and business models to the new era and leaders follow precedents set (M&C, 2017).

4.4 FUTURE TIMED

Timing the future pillar employs macrohistory and research about the monumental patterns of social change (Inayatullah, 2008). Grasping the historical social patterns of people, entities,

communities and countries as a unit can manifest in discernment of their patterns of change and understanding which phase of the pattern is representative of current situations. By laying hold of 'where one is at' in the grand scheme of things (pattern), decision-makers can decide where one might be going (Inayatullah, 2005; Gould, 2008). Macrohistory is a tool for better understanding the next five decades, century or even millennium (Inayatullah, 2012) so as to make sure that individuals are not extremely influenced by any particular shape of the future, especially the linear, which assumes the status quo.

4.4.1 A macrohistorical view of education

From a historical, developed world perspective, Gidley (2013) identified three broad phases, including informal education, formal school education and a variety of post-formal pedagogies (see Table 4.3).

Table 4.3: Socio-cultural, political and educational phases

	Prehistory to 18th Century	*18th to 20th Century*	*20th to 21st Century and Beyond*
Socio-Cultural Phases	Pre-modern	Modern	Post-modern
Political Phases	City-states	Nation-states	Global-planetary
Educational Phases	*In*formal family/tribal enculturation, or elite tutoring	*Formal* schooling, mass education, factory-model	Pluralism of *post*formal pedagogies, integral, planetary sensibility

Source: Gidley (2013)

Before the First Industrial Revolution, education for children was an informal process through their extended families. In the 19th century, during the peak of the British Industrial Revolution, schools became training grounds to provide factory workers (Gidley, 2013). In the United States, factory model education began about 150 years ago (Dator, 2000). Gidley uses the term "evolutionary pedagogies" instead of "educational transformation", because the latter is restricted by the philosophical perspective, doctrine or even paragon to which it subscribes. The earlier links education more consciously with the evolution of a new archetype of thinking (Gidley, 2013).

According to Gidley (2013), three waves of educational impulses have shaped the progression of education since the advent of the 20th century. Firstly, "Weak Signals", from the 1900s, where educationists did not give in to the weight of industrialism, secularism and so on, but subscribed to evolutionary notions of consciousness, culture and even cosmos. However, these approaches remained on the periphery. The second wave was known as "Alternative Education", in the 1970s, which was ignited by the Consciousness Movement. This paralleled the advent of Futures Studies. Alternative Education meant home-schooling, holistic education, futures education etc. Currently, the 21st century is experiencing the third wave characterised pedagogical methodologies (see Table 4.6) that reflect (evolution of consciousness) new ways of thinking (Gidley, 2009; 2013).

Table 4.4: 21st century pedagogical approaches

Learning	Flexible learning; maker learning; personalised learning; team-building for learning; project-based learning; emotional learning; self-directed learning; problem-based learning; constructivist learning; game-based learning
Education	Finnish education; spiritual education; global education; flipped education; character education; holistic education; start-up education; post-structuralist education; sustainability education; competency-based education

Source: Author's own construction, based on environmental scan

Inayatullah (2017b), advocates going back into history and recognising not only trends or emerging challenges, but also deeper historical patterns. Through anchoring itself in deep patterns, the robustness of Futures Studies is realised. It also ensures that scenarios and visions are unrealistic, but conceived by historical understanding. A plausible future can then be framed around the unchanging, likely to change and (disruption) "have we seen this before?" (Inayatullah, 2012; 2017). Divergent ideas have arisen from studies done by macrohistorians over thousands of years. The four core patterns are:

- The future is linear, good, progressive and attainable through devotion and hard work.
- The future is cyclical, with role reversals because of the inability to adapt on the crest.
- The future is spiral, with linear, progress-based and cyclical parts.

- New futures are frequently championed by a creative few, thus challenging the idea of a used future through political, spiritual, cultural, social or technological innovation (Inayatullah, 2008).

4.5 DEEPENING THE FUTURE

The fourth pillar deepens our understanding of the issues involving the creation of the future and Causal Layered Analysis (CLA) is critical for deepening the future (Inayatullah, 2008). CLA is a tool for exploring the world of the alternative futures that are investigated, looking at the present and the past with a multidimensional approach (Puglisi, 2001). The goal of CLA is not to forecast a certain future, but to open up the past and the present so as to formulate alternative futures (Inayatullah, 2004)

CLA uses a structured exploration of four layers of causation to facilitate a deeper critical inquiry. The four levels of analysis are:

- The **litany**: a study of the trends and issues of the future. Many futures researchers usually operate on this level and their assumptions are not questioned (Puglisi, 2001).
- The **systemic**: gives interpretation to qualitative data analysed from social, economic, legal and ecological perspectives. This analysis is found in journals or newspapers (Inayatullah, 2008).
- The **worldview**: a deeper level, connected with discourses and debates. Assumptions are explored through cultural, feminist, ethnical and ideological perspectives, as well as discussions about globalisation, population and consumption (Puglisi, 2001).
- The **myth/metaphor**: this refers to the deep stories, emotive views of issues, the unconscious dimensions of a problem and overcoming the data and discourses to go deeper in the level of knowledge (Puglisi, 2001; Inayatullah, 2008).

Movement from shallow to deep levels of learning, and vice versa, challenges assumptions and breeds novel ways of thinking about the future. This leads to actions and policies that are more effective. Scenarios can be used to provide horizontal breadth at any of the levels of CLA (Riedy, 2008). New litanies based on the views of different stakeholders are examined and make it possible to see how scenarios are constructed (Inayutullah, 2013). Clearly CLA sanctions and stimulates the advent of authentic alternate scenarios and preferred futures (du Plessis, 2016). As a result, it is of great import to deepen the exploration into the future of

tertiary education in the South African context by prodding the underlying stories, assumptions, social causes, metaphors and worldviews about the education institutions' skills transformation readiness and capabilities.

4.6 APPLICATION OF CAUSAL LAYERED ANALYSIS

An issue chosen for the CLA is conceptually unpacked from four levels of perspective. CLA "uses all four perspectives; that is, it contextualises data (the predictive) with the meanings (interpretative) we give them, and then locates these in various historical structures of power/knowledge – class, gender, ethnicity, and episteme (the critical), along with the unconscious stories that express, and to a certain extent, define the episteme" (Inayatullah, 2004, p. 5).

Mapping reality from the perspective of multiple stakeholders allows the futurist researcher to create robust scenarios. It aids futurists in understanding current reality by providing a tool with which to dig deeper and more broadly, allowing the creation of a preferred future that is robust in its implementation (Adendorff, 2013; Inayatullah, 2013).

According to Inayatullah (2004), CLA has many advantages, especially as a precursor to the scenario or strategy development phase, because of its ability to create a vertical space for constructing scenarios of different categories. The following gains arise from using CLA:

- Using alternative layers of analysis to form policy activities.
- Policy actions that viably solve problems in lieu of simply reinscribing issues.
- Facilitating the broadening and richness of scenarios to be used in the selection.
- It displaces shallow debate (discussion) to reach deeper dimensions of knowledge.
- It considers both the harmonious and opposing stances of participants.
- The artistic and non-textual expression of the futures process is suited to many people groups.
- It develops organisational leadership: problem-solvers, leaders and storytellers.
- It helps citizens ask questions of their leaders (political, business and community).
- It re-establishes a vertical form of social analysis, drawing from postmodern relativism to global ethics. (Inayatullah, 2004).

This research applies CLA to literature reviewed at a tertiary level and the possible futures for skills transformation under four headings, described in Tables 4.5 – 4.8 below, as follows:

- Table 4.5: CLA – Understanding the role of tertiary education – '**Sustainability'**
- Table 4.6: CLA – Understanding the role of education in skills development – **'Labour and institutional'**
- Table 4.7: CLA – Assessing the readiness of South African tertiary education for FIR – '**Technological'**
- Table 4.8: CLA – Analysis of skills mismatch in South African – **'Future jobs'**

Table 4.5: CLA – Understanding the role of tertiary education – 'Sustainability'	
CLA layers	Assessment
Litany	Education is regarded as a solution to contemporary socio-economic problems like inequality, poverty and unemployment, but is failing to meet expectations. The educational system is not suitable for the digital revolution era.
Systemic	Education at tertiary level is an asset for social equity and sustainability. However, it can be the difference between the haves and have nots, as evidenced by a few top-quality institutions and many poor-quality colleges.
Worldview	Stakeholders expect graduate-inspired economic growth and work-ready students who can focus on active democratic participation and critical citizenship. Ideologically, education needs to foster skills development curricula that pivots towards practical educational experience for a healthy, fair and sustainable society.
Myth / metaphor	Universities and colleges are places of co-creation, learning places of enlightenment and deconstruction of knowledge (knowledge factories).
Source: Author's own construction	

Table 4.6: CLA – Understanding the role of education in skills development– 'Labour and institutional'	
CLA Layers	Assessment
Litany	Inadequate basic education system, ineffective TVET, funding, planning, poor governance, long delays in the development of occupationally directed qualifications affect the quantity and quality of workers. Tertiary education institutions should explore non-traditional educational systems that are linked to training, skills and competencies applicable for the workplace.

Social	The rise of lifelong learning, growth mind-set, non-academic certificates and the complex modern world demands skills-oriented education. Degrees are not only for study, but arm students with goals and skills needed to acquire and maintain jobs.
Worldview	Education leadership does not believe that skills planning is their priority. No one organisation should assume responsibility for developing skills assessment instruments and policy.
Myth / metaphor	'Education 4.0 meets Industry 5.0' with 'incubatorial classrooms', which will redefine what it means to be prepared for the future. This should mean getting stricter about accountability and standards, not less strict.
Source: Author's own construction	

Table 4.7: CLA – Assessing the readiness of South African tertiary education for FIR – 'Technological'	
CLA Layers	Assessment
Litany	Tertiary education remains the main medium through which people acquire the necessary skills to function and be relevant in the society. However, it is struggling to circumvent a complex policy environment as FIR-inspired changes flood in thick and fast.
Social	Funding, skills shortage, misplaced government priorities and poor results in STEM subjects hampers the production of FIR skills. There is insufficient understanding of disruptive changes, coupled with the lack of clarity about which actor should take the first step, which results in no one making the first move to change the status quo.
Worldview	Employers want education to emphasise analytical reasoning, critical thinking and collaboration. There is an urgent call to change to a sustainable business model that supports the practices of the future. Institutions will not survive if they fail to integrate disruptive technologies.
Myth / metaphor	'Education 4.0 meets Industry 5.0' for 'Professional Triathletes'. Co-creation with the no-collar workforce is characterised by lifelong learning.
Source: Author's own construction	

Table 4.8: CLA – Analysis of skills mismatch in South African – 'Future jobs'	
CLA Layers	Assessment
Litany	Future jobs, future skills, changing work, international market dynamics and environmental regulation affect skills supply and demand. Skills shortage

	affects productivity, wages and limits ability to change employment situations.
Social	Systemic institutional barriers make it difficult for some institutions to adopt digital learning. As such, they often cannot get access to accreditation bodies, even if this is only inadvertent. There is need for oversight, collaboration and the establishment skills development metrics in tertiary education.
Worldview	Government is part of the problem because of its inability to comprehend the business models used by businesses and perpetuating business as usual.
Myth / metaphor	Education 4.0 meets Industry 5.0. Blessed are the creative for they shall inherit the future. AIEd, measuring and evaluating vocational skills and nuanced skills. Upskilling and reinventing for international skills and 'sociotechnical' workplaces (age of the obsolete).
Source: Author's own construction	

4.6.1 Litany

The shallowest level depicts the media impression of an issue. The descriptions tend to be recognisable and apparent, and issues are laid out as independent, conjuring emotions of helplessness and apathy (Riedy, 2008). This is mainly because the problems are usually overstated, often used for political gain (Inayatullah, 2008). The problem looks like it cannot be solved, or the answers lie within government, meaning that it is not the responsibility of individuals (Inayatullah, 2008). The vertical layers are as important as the horizontal levels and in the official public discourse (litany), one needs to single out the problem, the solution, associated problem-solver (often the government in this case) and where to find the information (Fitzgerald & Inayatullah, 2009).

The first analysis of the litany issue was in terms of the role of education as depicted within media and debate in social and political circles. This revealed an inability to meet expectations. The current educational system is not only for centuries prior to the digital revolution (Robinson, 2009), but it is doing very little to dent the unemployment rate. SA youth unemployment (15-34 years) reached 38.6% in the first quarter of 2017. Worryingly, it is disproportionately high even among those with tertiary education (Merrington, 2017). On the education budget, South Africa currently outspends the US, Deutschland and the UK, yet South Africa's higher education system was rated 134 out of 138 countries in the WEF (2016-2017) Global Competitiveness Report.

The most diverse and differentiated higher education system in Africa is in South Africa. (Cloete, 2016). The performance of South Africa's educational institutions ranges from solid gold to middling (NPC, 2015). Normally, four of the five African universities in the Shanghai Top 500 are in South Africa. Similarly, in emerging economies' ranking, South Africa has three universities (UCT, University of the Witwatersrand and Stellenbosch University) in the Top 12 (THEWUR, 2016). At the lower end, a massive challenge is that sub-standard basic education increases the cost of producing graduates, and a relatively small number of black students graduate from universities (NPC, 2015). For the government, free higher education for the poor may be the answer, but questions need to be asked in terms of how it should happen (Cloete, 2016). In most countries, unlike in South Africa, very few poor citizens go to university. Over 70% of NSFAS-aided students did not graduate in the 2000-2006 cohorts, and it is even worse now, because the graduation rate is unknown and monitoring mechanisms are absent (Hall, 2015).

The aim of HE is "to contribute to the socialisation of enlightened, responsible and constructively critical citizens" (White Paper Post-School Education and Training, 1997). Alas, tertiary education has hardly made significant progress in as far as preparing students for a democratic society (Wilson-Strydom, 2014). While Leibowitz (2014) argues that the business of HE is for research, teaching and community interaction, education for a just and sustainable society is not given pre-eminence (McIntosh et al., 2001). Ironically, the graduates from top colleges and universities are the ones leading the charge towards the current unhealthy, inequitable and unsustainable path (Cortese, 2003). Despite the obsession with rankings, marketisation and heightening focus on higher education for economic growth, there is still space for implementing higher education for the public good (Wilson-Strydom, 2014).

In terms of the litany for skills development, the acute shortage for R&D workers has been singled out as stifling economic growth in every review since 1994 (Walwyn & Cloete, 2016). The Ministerial Review of Science, Technology and Innovation Landscape of RSA argued that the "biggest constraints are the stuttering pipeline of trained and knowledgeable people at all levels" (DST, 2012). According to Seekings and Nattrass (2015), the South African labour market deficiencies is the number one cause for dual issues of employment and inequality. The market is punctuated by declining low-wage opportunities for blue collar workers and higher earnings for office jobs. As early as 2013, the Reserve Bank has been calling for the tripling of

the growth rate of skilled labour (National Treasury, 2013). The CHE report surmised that the tertiary education system is not creating enough graduates to satisfy economic and social development obligations, mainly because there is no development of much of the nation's intellectual talent. In the best-performing cohort, only 35% graduated within five years, and 55% might never graduate (CHE, 2013). If 70 000 students from a cohort never graduate (CHE, 2013), then depending on higher education to reverse high-level skills shortages may be a far cry from reality

An analysis of the preparedness for the FIR shows that the Sub-Saharan Africa region needs to boost the quality of Science, Technology, Engineering and Mathematics in all levels of education, including TVET, to increase the chances of competing in technology-driven economies (WEF, 2017c). The contribution of South Africa's world exports to high technology manufacturing industries is minimalistic: 0,09% for the pharmaceutical industry; 0,07% for computers electronics and the optical industry; and 0,14% for the aerospace industry in 2013. Technological advancement and innovation (driven by South Africa's own 'MITs and Stanfords') will go a long way to resuscitate these sectors together with the other labour absorbing sectors championed by the NDP (National Advisory Council on Innovation [NACI], 2014).

With three in five jobs comprising at least 30% of constituent work activities that could be automated, productivity and economic growth will accelerate. Therefore, the demand for work and workers could increase, thanks in large part to growing economies and technological productivity (M&C, 2017). AI is reducing the shelf life of workers' current skills sets. For example, instead of completely replacing existing jobs, AI is likely to substitute specific tasks once done as part of these jobs. As a result, the freed workers will need to learn new tasks (WEF, 2016).

Finally, yet importantly on the litany issues, was the analysis of skills supply and demand based on future jobs. The reasons for the failure of education to adapt to the world around it include the challenge of identifying ways to develop systems of accountability around the nebulous future skills and insufficient resources to develop high-quality, career-ready students (Getting Smart, 2018). Education in South Africa is biased towards the acquisition of academic knowledge and cognitive skills, which are important in the labour market, but not sufficient for future participation in the working environment. Additionally, Africa's CEOs identify lack of

understanding of the disruptive changes underway as the sole major barrier to future workforce planning (WEF, 2017c). Tertiary education leaders must review the aim of education to prepare learners for the future world of work (Chatlani, 2018).

Several trends will facilitate millions of jobs by 2030 (M&C, 2017). These trends include: caring for the elderly, increasing energy efficiency, coping with climate change, creating goods and services for new consumption patterns, and the investment in technology and infrastructure development (M&C, 2017). Given the jobs lost and jobs gained scenarios, the higher education department, TVET and universities should be best prepared, but how do you prepare to teach and train for the emerging jobs or new jobs in 2040? According to Inayatullah (2017a), flexibility and adaptability is critical in this future. Both hard skills and soft skills are taking centre stage. The practical skills are vulnerable to change and disruption in the near future, so much so that by 2020, more than 33% of the required core skills sets of most jobs will accrue from skills that are not yet regarded crucial to the job today (WEF, 2016).

4.6.2 Systemic (social) analysis

Level 2 provides analysis predicated on quantitative data, technical descriptions and scholastic interpretations, including the roles of different actors (Riedy, 2008). According to Conway (2012), the social level investigates the systemic factors (trends) that are thought to be driving the association described by the litany. Systemic solutions need interventions by efficiency experts and, as a result, governmental policies with input from the private sector often materialise (Inayatullah, 2009).

As alluded to in the section on litany, education is supposed to help eradicate poverty, reduce inequality and champion environmental issues. Alas, sustainability is just not a priority in tertiary education because of structural bureaucracy. Additionally, interactions between people, human activities and the planet, and strategies, technologies, and policies for a robust, equitable and an ecologically sustainable future are among the most multiplex and composite issues with which society must deal (Cortese, 2003). Most of the systems in education are in a state of paralysis, because education leaders are unable to reinvent the role and purpose of tertiary education in a changing environment. There are issues with limited state funding, governance, quality assurance, regulation, institutional autonomy and other drivers of change re-shaping the purpose of higher education (Mabelebele, 2015).

The litany on the role of education in sustainability revealed that tertiary learning institutions ought to inculcate the knowledge, competencies and skills that pave way for graduates to contribute to economic development. Consequently, such development further supports social equality and social development (Mouton, Louw & Strydom, 2013). However, a systematic, holistic, comprehensive evaluation of the South African education system is missing, as analysis tends to focus on one facet of the problem, without dissecting how that one facet fits in with the many other parts of the education system (Wolhuter, 2014). An evaluation of any national education system can happen in a number of ways. Firstly, it requires measuring it against the objectives of that education system, as they appear in official policy statements (bills, education policy statements, white paper, and so forth). Secondly, the education system could be weighed up against the contextual demands of the country (PESTLE). Thirdly, the education system could be measured against international benchmarks, such as data from UNESCO, World Bank and studies from PIRLS (Wolhuter, 2014).

The problems in tertiary education in Africa are fundamentally historical, but some are a result of bad policy choices (Mabelebele, 2015). One of the enabling milestones, according NDP 2030, is to ensure that skilled, technical, professional and management positions fairly reflect the country's racial, gender and disability makeup (NPC, 2015). The need to transform institutional cultures and policies to accommodate previously disadvantaged academic staff and students is causing commotion in universities, as some sections are concerned that second-order function is usurping research and teaching (Archer, 2017). Government is in a precarious position, because it needs to redress pass injustices but, at the same time, not make it a bad policy by failing to implement it properly. Cloete (2016) contends that demanding that universities reflect current population demographics is an inappropriate use of transformation concepts, because bad policies have long-lasting consequences and cannot be redressed or wished away in a decade or two (Cloete, 2016). According to Archer (2017), elevating affirmative action, a second-order function, above what have historically been the defining features of a university for over a millennium, has probable destructive consequences overlooked by academics, administrators and policymakers.

The high level of fragmentation has resulted in large numbers of accredited private providers and private training centres, but the system does not possess the capacity to provide adequate quality assurance. This is partly because of no coordination between the many quality

assurance bodies (CHE, UMALUSI and SETA ETQAs) and a lack of standardisation in ETQA policies, practices and requirements across the different SETAs, which compounds inefficiencies (Marock, 2010). Owing to differences in quality of education, Van den Berg (2015, p. 214) argues that "the large differentials in earnings and access to jobs between the highly educated and the less educated lies at the heart of income inequality. The high wage premium to educated workers derives from a combination of a skills shortage at the top end of the educational spectrum, driving up wages of the educated, and a surfeit of poorly educated workers competing for scarce unskilled jobs, thus dampening unskilled wages".

An analysis of the causal variables of education readiness for FIR reveal that the postgraduate system in South Africa is at about 16% (DHET, 2013). The participation rate is a critical tool for measuring performance, as there is a correlation between higher education participation levels and economic development (World Bank, 1999). Botswana's participation rate is 20%, Mauritius 26%, which the WEF refers to as 'efficiency-driven economies'. With participation rates of above 80%, Finland, South Korea and the US are known as 'innovation economies'. (Cloete, 2016). It would be folly to suggest that South African tertiary institutions are ready to provide the skills needed for the FIR when the learning institutions themselves have not adapted to digital and intellectual transformation. As of 2012, South Africa had 1.5% of Full-Time Equivalent (FTE) researchers per thousand in the workforce, although there has been an uptick of 9.2% doctoral degrees completed between 2012 and 2013. The NDP 2030 acknowledges the problem of a low proportion of PhD-bearing teaching staff in higher education institutions. Investment in future R&D capacity is vital to turbo charge South Africa's innovation capacity (NACI, 2014).

In order to solve Fourth Industrial Revolution induced challenges, South Africa needs a reimagined tertiary education. In the Industry 4.0 era, an unprecedented rate of change in the core curriculum content means that nearly 50% of subject knowledge gleaned in the first year of a technical degree will be obsolete at the time of graduation. 65% of all grade one learners will work in completely new job types that do not yet exist (Merrington, 2017). Combating the scourge of structural skills mismatch demands dialogue between education and work so that different stakeholders in the education-to-work process can communicate skills needs, develop curricula and share the delivery of education and training in schools and in the workplace (WEF, 2014).

The intricacies of FIR elements amplify one another, leading to a revolution that is more comprehensive and all-encompassing, and with far reaching consequences. The technological revolution is also happening in a melting pot of broader socio-economic, geopolitical and demographic megatrends, each interacting in multiple directions and influencing one another (WEF, 2016). It is impossible to weather the disruption revolution by waiting for the next generation's workforce to become better prepared; the current workforce needs to be as prepared. Disruptive innovation and globalisation place a premium on highly-skilled knowledge workers. If skills supply does not go up at the same pace as technology growth, unskilled workers will earn less (Van den Berg & Piketty, 2014). Additionally, they will be relegated to mundane jobs, thereby increasing inequality. In this context, the 'have-nots' are high school and tertiary education dropouts and the 'haves' are the educated (Cloete, 2016).

The Oxford Martin School estimates that only half a percentage point of today's US workforce is employed in sectors created since 2000, relative to the 1980's which birthed 8% (Schwab 2015). According to the OECD (2012), up to 80% of the decline in labour's share of national income between 1990 and 2007 was technology driven. A McKinsey & Company (2017) scenario suggests that by 2030, 75 million to 375 million of the global workforce will need to change occupational categories. Not only that, but all employees will also need to adapt, as their jobs transform in tandem with increasingly capable machines. This only increases the need to adapt by getting a higher educational qualification, or spending more time on activities that require social and emotional skills, creativity, high-level cognitive capabilities and other skills relatively hard to automate (M&C, 2017).

4.6.3 Worldview

Level three "is concerned with structure and the *discourse/worldview* that supports and legitimates it" (Inayatullah, 1998, p. 820). According to Conway (2010), the discourse analysis finds out the assumptions driving the systematic causes, the actor with a dominant perspective and whose voice is not being heard. Being sensitive to heavy assumptions behind the problem is vital, including attempts to re-vision the issue, thus exploring a myriad of discourses that cause or mediate and importantly constitute the issue (Inayatullah, 2004; Riedy, 2008). The quadruplet sub-levels identified by Inayatullah (2004) include: stakeholder, ideological, civilisational and epistemic.

According to Robinson (2009), the present-day educational system runs on obsolete needs and assumptions and churns out students who can only tackle problems of a historical world (Bodinet, 2016). This is not surprising, because the rudimental process of thinking in education has its roots in a historical context of the 1900s that informs the nature of education today (WWF, 2012). The classical philosophies of education are classified as educator-centric, student-centred and society-centred philosophies (Lynch, 2017). In terms of essentialism philosophy, there is an inner core to a subject, a topic-specific knowledge. The premise is that lecturers have knowledge, while students are passive recipients who should get facts and be taught necessary skills in different subjects (WWF, 2012). This constitutes the current education system, which is fallacious, devoid of creativity and transformation, a mere transfer of information (Bodinet, 2016). On the contrary, there is the perennialism philosophy. A perennialist focuses primarily on personal development and the idea that learning institutions should not focus primarily on factual matters. Rather, it looks to facilitate eternal principles like humanness, major life issues and ethical issues (WWF, 2012). The discussion on other educational philosophies will follow later.

An analysis of **education sustainability** discourse touches on the genealogy and the framing of problems, the paradigms, justification of the issue and stakeholder solutions. Nelson Mandela said, "Education is the most powerful weapon, which you can use to change the world." Ironically, this study explains the paradigm that legitimises inequality, power and other issues that oppose sustainable development. The lecture-based system is at the heart of exploitation, social inequalities, replication of social structures and other ills because the pedagogy is as much a by-product of oppressive social structures, as well as being a mechanism that perpetuates the system (Bodinet, 2016).

Michel Foucault (1972, p. 227) observed, "Education may well be, as of right, the instrument whereby every individual, in a society like our own, can gain access to any kind of discourse. But we well know that in its distribution, in what it permits and in what it prevents, it follows the well-trodden battle-lines of social conflict. Every education system is a political means of maintaining or of modifying the appropriation of discourse, with the knowledge and the powers it carries with it." Therefore, there should be an acknowledgement of the role of education in the creating of systems of power, privilege and oppression, as well as the general discourse of our social realities.

Universities have always been elitist in their culture and practice, only selecting individuals with intellectual abilities needed for academic success (Archer, 2017). South Africa is between a rock and a hard place, because access to tertiary education maintains the privilege of the 'haves', and increasing access for the 'have-nots' is a means of getting out of poverty (Cloete, 2016). According to Piketty (2015), the massive wage inequality in the US is a reflection of poor investment in higher education, resulting in many being unable to afford the necessary training required to shrink wage inequality and make the country equal and globally competitive.

Tertiary education inherently has great social and political value. As Nussbaum asserts, "education is intimately connected to the idea of democratic citizenship and the cultivation of humanity" (2006, p. 5). Moreover, tertiary education sees value in the promotion of health and well-being, and champions the pursuit of social and human rights (Mouton et al., 2013). Environmental Education (EE) and Education for Sustainable Development (ESD) lie within the ecocentric worldview, which "recognises intrinsic value in ecosystems and the biological and physical elements" (Curry, Whyte & Grey, 2018). Ecocentrism relegates human needs to subservient to the earth's needs. On the contrary, the technocentric paradigm, which advocates for human superiority of the neo-liberal industrial age, can be regarded as the major contributor to our current ecological predicament (Bonnett, 2013).

The curricula need to interrogate assumptions that are dangerous, for example: humans should have dominion over all species and are separate from the rest of nature; technology will solve most of society's problems; materialism can meet all human needs and wants; personal success is mutually exclusive from the health and well-being of communities, cultures, and the life support system (Cortese, 2003). Transformation in education should start accepting that the crisis of the global environment is fundamentally a crisis of values, ideas, viewpoints and knowledge, which makes it a crisis *of* education, not one *in* education (Orr, 1994).

A **skills development** stakeholder analysis, including businesses and employers, revealed that there is an 'ethical awareness' in business circles about the need to lower the skills gap and develop employees' skills, which could increase the bottom line, maintain a competitive edge and decrease costs. Once again, the issue of the bottom line instead of the triple bottom line is the deciding factor for many firms. According to Grand-Clement (2017), businesses and employers will push for transformation in digital education only if it benefits revenues or saves

money. There is a social status associated with tertiary education, especially if a community (as a stakeholder) puts value on education as a social benefit – students and people in that community will aim to achieve it in order to increase their status in the community (Chesser, 2013).

Progressivism as an epistemic discourse shapes the role of education in skills development. The goal of progressivism is experiential learning, where the student is front and centre. Students develop themselves through real-world experiences and activities that centre on the students' actual situation. The instructor assumes the role of a guide and facilitator (WWF, 2012). Institutions need to prioritise driving up the quality of student experience through promoting novel ideas, implementing successful models and incentivising teaching innovation with learner success at the centre (Adams et al., 2017). Tertiary education needs to condition students to be entrepreneurial and resilient, with the mind-set of continuous learning and reinvention of themselves and their careers multiple times in their lives (Chatlani, 2018).

Skills development is not optimal because of the after-effects of apartheid (NDP, 2015). However, truism says tertiary education is providing equal opportunity for all citizens (Lewis, 2013). After 1996, non-white doctoral graduates went up from 58 to 821 in 2012 (a 706% increase), relative to white graduates who grew by 71% (from 587 to 816). Black female graduates rose from 10 in 1996 to increase by 960% to 106 in 2012. In contrast, white male graduates plateaued around 367 in 16 years. If transformation is counted as improvement in percentage change, then black females have amassed extraordinary gains, particularly in comparison to white males. Such an uptick has not been found even on an international level over such a short period of 16 years (Cloete, 2016).

Skilling for development maybe be the only means of economic liberation for the poor. The argument for free tertiary education finds its roots in a traditional **discourse of development** (Ariell, 2010). "This discursive framework implicitly equates progress with industrialisation and increased productivity – given as a blueprint for the attainment of prosperity for all" (Truman, 1949, in Esteva, 1992, p. 6). The presupposition that this fashion of 'development' will solve the challenges of poverty and social justice legitimises ill-conceived policies that have a veneer of industrialisation promotion, frequently without considering their political or even social implications (Dickson, 1974).

To increase employability in the Fourth Industrial Revolution era, there is an urgent need to promote internationalisation strategies that aid international mobility and intercultural skills. This will ensure a stronger link between higher education and practice, since the current education is no longer sufficient to meet the needs of professional practice (M&C, 2017). In the same vein, education leaders should consider providing students lifelong learning skills through global collaboration (Chatlani, 2018). "Capacity imbalance would argue for increasing use of technology and blended learning, creating more joint ventures, and combining institutions with specialised focus" Gill (as cited in Chatlani, 2018, para. 12).

An examination of the preparedness of tertiary education for the FIR reveals sobering prospects. The role of higher education has not changed for the 600 years since the inception of the earliest universities of Bologna, Oxford and Cambridge, namely to prepare young people for jobs and to help them understand how to live (Lewis, 2013). Creating and implementing 'future-proof' basic and vocational curricula includes digital fluency and ICT literacy skills, since emerging jobs are increasingly becoming digital technologies intensive (WEF, 2017c). From the stakeholder's (government and policymakers) point of view, there is an unawareness about what is transpiring in the digital world, and the exponential pace of development of digital education. Both affect the development of a holistic strategy, as it takes time to process and monitor strategies (Grand-Clement, 2017). No wonder 33% of American tertiary education students graduated without developing the critical skills required for vocational success and for discharging the responsibilities of a citizen in a modern democracy (Lewis, 2013).

South Africa's investment in innovation has been biased towards big science projects at the expense of priorities in business and social development (Department of Science and Technology [DST], 2012). Critics say that South Africa's choices for specialisation have been misguided and misinformed, long-cycle, science-based sectors, instead of short-cycle, technology-based opportunities, which are more likely to yield the desired economic outcomes (Walwyn & Cloete, 2016). The misguided and myopic specialisation shows that there is little collaboration among entities seeking to solve skills gaps in their own workforces, as well as the communities around them. This results in uncoordinated, potentially wasteful, efforts (WEF, 2017c). The solution lies in *consciousness transformation.* As educationists in the 21st century try to grapple with education that is mostly suited to the 19th century, Gidley (2013) raises three key insights. Firstly, knowledge is evolving and specialisation is redundant to 21st

century complexity. Secondly, consciousness is evolving. Thirdly, education belongs in the realm of culture (it should develop the minds, hearts and souls of learners), not economics.

Social reconstruction as an educational philosophy is worth mentioning here because of its importance to future jobs. Instructors furnish students with tools they need in order to change society. The student has social change and the future in focus, because the society is always transforming. The learners are able to sharpen their critical thinking skills (WWF, 2012). In light of Einstein's argument that "we cannot solve our problems with the same level of thinking that created them", students need to think differently. This should then be coupled with restructuring the education system to mirror various characteristics in society (Bodinet, 2016). Social constructivism posits that human development is socially situated, and knowledge is built through interaction with others (McKinley, 2015). Furthermore, people create meaning, rather than acquiring it (Ertmer & Newby 2013).

The learning centres of the future must facilitate creative spaces for both students and facilitators to nurture human qualities and come together in a holistic learning experience. Such classrooms will make it possible for students to deconstruct and apportion their personal knowledge, their experiences and their dwelling places. The premise is that graduates of such 'incubatorial classrooms' are ushered into the working world knowing themselves, their competencies and desires, as well as a clear comprehension of their colleagues and the world they live in. Students get better at critical thinking and deep listening to the point that they are better equipped to deal with global risks (Bodinet, 2016).

4.6.4 Myth/metaphor

Level four is the deepest layer, focusing on "the deep stories, the collective archetypes, the unconscious dimensions of the problem or the paradox" (Inayatullah, 1998, p. 820). The aim of this layer is to elicit visual images, strong emotional effect (instead of appealing to the head) with generalised language (Inayatullah, 2004). According to Riedy (2008), the objective is to pull out and deconstruct ordinary metaphors, vocalise proxy metaphors and bring the unconscious and the mythic to futures work. "While there are myths, metaphors at all levels of consciousness, it is only at post-conventional levels that one is able to reflect on and compare these myths and metaphors" (Riedy, 2008, p. 155).

The first metaphor selected for this stratum is '*Education 4.0 meets Industry 4.0',* with **co-creation** ecosystems driving co-existence with AI and co-bots. Ramaswamy & Ozcan (2014) proposed a framework for a firm to transform its business ecosystem into what they call the co-creation paradigm. Tertiary education institutions need an *ecosystemic business model* to coalesce the strategic drivers and goals of various ecosystem stakeholders under a mutually coupled opportunity that propels value co-creation, co-capture and competitive advantage (Marika, 2016). The co-creation paradigm framework, according to Ramaswamy & Ozcan (2014), is used to induce organisational change. It focuses on the experiences of all the stakeholders who would be involved in or affected by the new offering (Ramaswamy, 2010), instead of caring only about the customer. The stakeholders are thus not passive recipients of processes designed by the education institution, but part of cross-sector innovation and engagement (Ramaswamy & Gouillart, 2010).

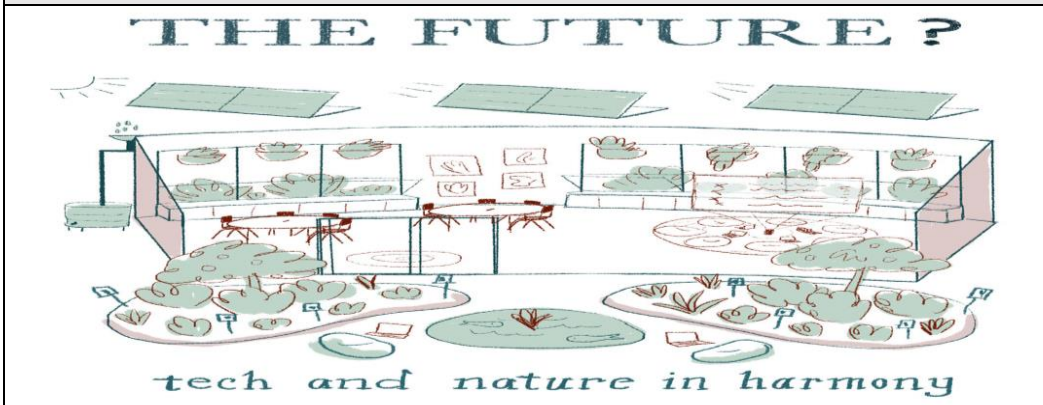
In the education domain, co-creation is mirrored in students' assessments of their experience, and arises from both consumer and provider participation (Dean, Griffin & Kulczynski, 2016). Therefore, co-creation of value at university or college should encompass experiences that lead to confidence about post-school life, that is, expectations about independent value creation. The emphasis is on working together with students to co-produce lifelong learning. Engagement in learning is essential if co-creation is to occur, because co-creation requires establishment of a collaborative, dialogical platform (Grönroos & Gummerus, 2014; Dean et al., 2016). The tertiary institutions pivot from being passive creators of knowledge to active players in manifold, collaborative discovery activities (Fleischman et al., 2015).

In line with the discourses of the role of education in the creating of systems of power, privilege, inequality and oppression, education can be seen as mere social control. Newtonian Fordist factory models of education evoke images of being shackled to the same desk, doing the same thing repeatedly. In a way, it communicates being imprisoned in one job for life. Alternatively, tertiary institutions should be places of freedom, exploration and endless beauty. These institutions should be associated with metaphors like '*Garden of Eden'*. A co-creative education system frees the shackled mind to focus on wholeness, which is a deep view of the mind as 'body–mind–spirit' (Bussey, 2008). Extending the 'Garden of Eden' metaphor, emphasis pivots from content to process, and knowledge will be a personal and social quest that culminates in greater welfare of all and augmentation of one's sense of spiritual self (Inayatullah & Bussey, 2008).

The interwoven nature of people, profit, planet and technology means they cross over disciplinary boundaries, whereas tertiary education is highly structured into immensely specialised disciplines and knowledge areas. Creating a sustainable future demands a pivot toward a systemic perspective emphasising collaboration and cooperation. The capitalistic nature of tertiary education stresses individualistic learning and competition, leading to independent professionals who are clueless about collaborative efforts (Cortese, 2003). Optimistic futurists posit that machine-to-machine technology will drastically affect **economic surplus** so "that we could collectively afford to liberate much of humanity from both labour and suffering" (Lim, 2016). A transformed workforce means that the knowledge passing on between generations will not be data-based, but about the sharing of emotional, spiritual and new forms of intelligence, such as empathy (Bear, 2017; Colvin, 2015). Without a doubt, the talk of the town will be, "How well do you get along with your robot?" (Fisher, 2015). In these conditions, a true cooperative economy is on the table (Neuner, 2013). This will represent a transition from the contemporaneous corporate model to a sharing economy and, eventually, to a cooperativism platform (Inayatullah, 2017).

A myth worth considering is that all institutions will make **sustainable** design a bedrock of education and practice. The 'domination of nature' theory, which is central to the current scientific worldview, is informed by a myth of human autarchy from nature. This mythology juxtapositions humans and nature in a binary antagonism, where the 'environment' is entirely exterior and divorced from the subjective human entity (Ariell, 2010). However, the Ecomodernist Manifesto (2015) declares that a reasonable Anthropocene must allow for the embracing of technological development without disadvantaging the ecological world. Incidentally and principally, regardless of the era, "the design of the classroom is a technology, and you can interpret that in a lot of different ways. Architects can make that look more, and less, typical. But the point is the instruction, the interaction in the classroom, not that it looks more like a circle or more like a square or whatever else" (Lange, 2018).

Figure 4.3: Technology meets nature



Source: Lange (2018)

There is an emerging trend of technologies inspired by nature, coupled with nature and technology merging (Jacobs, 2015).What will tertiary institutions of the future look like? It is neither forest nor urban farms campuses, or tablet-contained education, but future designs could combine the two (Kamenetz, 2018) – see Figure 4.3. At the heart of ESD is envisioning: if we know where we want to go, we will be better able to work out how to get there (WWF, 2012). When educational institutions address sustainability, the result (generally) is improving the quality of life for every one of earth's inhabitants, now and in the future (Burke, 2010). ESD leads to students acquiring the values, knowledge and skills required to shape their own way of life and society in a sustainable way (Dannenberg & Grapentin, 2016).

The second metaphor chosen is the ***'****age of the obsolete'***,** named for Rovito's book of the same name. This metaphor represents near end times' ominous impact of AI and smart machines as being characterised by destroying jobs, skills not lasting, multiple jobs, technology obsoleting itself. Rovito (2018) paints a picture of a dying 'American Dream', where the people thought that the future would be "more of the same - only better". In the not so distant future, the confluence of automation, AI and offshoring may render a significant portion of the American workforce economically obsolete. This is inclusive of white-collar jobs in the financial, legal and healthcare professions (Rovito, 2018), signifying a 'no one is safe' scenario. Scenes of Tipsy the Robot bartender (an automated mixologist who slings bespoke cocktails) nearly bringing bars of Las Vegas to a grinding halt in May 2018 added to the fears of the 'Sin City' servers. It is scary that AI systems are rapidly gaining capabilities and skills once thought to be unique to humans (Salkever, 2018). Many associate obsolescence with old technology or rusted

implements, but it is also possible for people to become outdated or no longer useful (Rovito, 2018).

AI will destroy a plethora of jobs, but it will create a lot too, for example, *man-machine teaming manager* (Stillman, 2017). Work, in and of itself, will not become obsolete in the FIR era. In fact, historical data shows the likelihood of an impending societal shift, whereby the nature of work evolves to cater to advancing human needs (Chinner, 2018). Yet how does one prepare for new jobs manifesting in 30 years' time? Equally tricky is predicting when to stop training for skills that will become redundant. Additionally, since the human-machine workforce will be ubiquitous, there is a need for someone to mediate that partnership. Meet the man-machine teaming manager. A Cognizant's fictional advertisement declares that companies will have to hunt for "individuals who can help combine the strengths of robots/AI software (accuracy, endurance, computation, speed, etc.) with the strengths of humans (cognition, judgment, empathy, versatility, etc.) in a joint environment for common business goals". Learning outcomes should target producing "*Professional Triathletes*", who can excel in the many dimensions that would be needed for the workforce of the FIR (Diwan, 2017).

Human resources departments will focus not only on employment equity as we know it today (involving fair hiring in terms of gender, race, and sexual orientation), but will also look at genetic diversity to "integrate a workforce that includes workers who have been genetically enhanced with those who have not". Tertiary education should be involved in researching the jobs that AI cannot do, training people to do them. The most urgent need is to reinvent education so that it moves at the pace of the FIR (Lee, 2018). The problem comes when human-centric skills such as "empathy" and "management" prove to be more malleable to AI than we originally envisioned (Salkever, 2018).

According to a Harvard Business Review (2013) survey of 12 000 professionals, 50% felt that their work had no "meaning and significance". Another poll among 230 000 employees in 142 countries showed that only 13% of workers actually like their job, and 37% British people think they have a useless job (Yougov, 2015). According to Bergman (2017), a Universal Basic Income (UBI) could solve the dilemma of advancing AI and robotics. Rovito (2018) also points to UBI as a solution to bulldozing technological unemployment. This is not because robots will steal all the meaningful jobs, but because a basic income would give everyone the chance to do work that is purposeful. The UBI makes sense, because machines can do half of all work-

related activities better and at almost no cost. The extra money made by AI can be distributed to the people who lose their jobs. The advocates for UBI think that the additional income will help people find their new path. However, UBI doesn't address the people's loss of dignity or their need to feel useful (Lee, 2018).

Bregman (2017) believes in a "future where the point of education is not to prepare you for another useless job, but for a life well lived…where jobs are for robots and life is for people." Futurist forecasts four-hour days within just 30 years (Marginalia, 2017). The sub-optimal current eight-hour workday was set up to maximise on routine tasks. Emerging research shows that the optimum is around four hours per day. Additionally, as robots and 'cobots' execute more of the regimen tasks, humans will become more creative. It is no longer a matter of human versus machine, but preferably human and machine working together to solve the world's problems (Kasriel, 2017). The four-hour day will have huge rewards on our sleep, health and well-being, as well as balancing family life (Marginalia, 2017).

4.7 CREATING ALTERNATIVES

Alternative futures formulation happens in the fifth pillar. This is in line with Inayatullah's (2008) structural guidelines, attained through the construction of scenarios, to expand upon the future of tertiary education in South Africa. In creating alternatives, the overarching aim is to apply the scenario methodology by studying the likely scenarios and confronting the challenges faced by the South African tertiary education in preparing for future skills. According to Puglisi (2001), scenarios will provide a sketch of a hypothetical future and be used as extraordinary means for meeting the challenge of future uncertainties. The objective of scenarios is to formulate a broad view of our reality, gaining a perspective that enables us to grasp "not only what it is now, but also what it might be in the future" (Puglisi, 2001).

Scenarios talk about the future in the form of stories that decision-makers and other generalists can understand, albeit not in an arbitrary fashion. They are meticulously crafted to mirror the logical implications of assumptions and forecasts about the future (Gray & Hovav, 2011). Scenarios are unparalleled as a tool of futures studies (Slaughter, 2002) and they must pass the test of being possible, plausible and internally consistent (Gray & Hovav, 2011). A good set of scenarios needs to leave the reader questioning whether the alternative under consideration is highly likely to occur (or probable), thereby encouraging the reader to mull over the subject

further (Adendorff, 2015). Actually, good scenarios are a product of a robust CLA, not the workings of the artistry of a novelist or a science fiction writer (Gray & Hovav, 2011).

Scenarios highlight dissimilarity or contestability between distinctive futures images (Gould, 2008). Scenarios evoke a sense of empowerment and stimulate action to create alternative images, thus offering choice and capacity for change (Inayatullah, 2005). Out of these contradistinctions, image-rich alternative futures can be mapped and a preferred scenario entrenched. Thereafter, by aligning preferred images of the future with specific strategies and measures, a path towards a preferred future is solidified (Gould, 2008). The extensive scenario-building model designed by Peter Schwartz, which focuses on the organisational and offers specified guidelines with which to plot and develop scenarios, has been adopted for the purpose of this research. The scenario structure is composed of the following four variables (Inayatullah, 2010), which are tagged using rock music titles to underscore the congenital 'stories' of the scenario analysis:

- Best case (towards which the establishment wishes to move) - **"Stairway to Heaven"**
- Worst case (most severe possible outcome) - **"Highway to Hell"**
- Outlier (a surprise future which is disruption inspired) - **"Bat out of Hell"**
- 'Business as usual' (status quo) - **"Still Raining"**

4.7.1 "Stairway to Heaven" – the best case scenario

Led Zeppelin's song paints a picture of a woman who shines white light and wants to show how everything still turns to gold. The opening verse of "Stairway to Heaven" starts by saying: all that glitters is gold. The scenario's title dovetails with the gold standard, which is heaven. By the year 2030, "Education 4.0 meets Industry 4.0" is a reality. The transition from consuming and producing knowledge to empowering innovation education has been finalised.

To meet the FIR's knowledge and skills requirements, Education 4.0 has to leapfrog the current Education 2.0 framework so that there are innovative applications of knowledge. The focus of Education 4.0 is "experiential learning", delivered across technology-enabled platforms, using cross-integration with industry and society. Universities and colleges fulfil the function of knowledge creation and dissemination. Industry offers skills application places and collaborates on research. Society awaits high emotional quotient (EQ) individuals who will

tackle community problems collectively, and learners expect greater flexibility, matching their aspirations. Government ensures minimum standards, but has only a minimal role in the area of policy and regulation. Relevant skills and job readiness become much more important than accredited education and the demand pivots toward vocational skills, because the FIR requires cross-functional roles in terms of both technical and social skills. Agile, flexible and tailor-made curriculum will need to become the prevalent methodology for training, including apprenticeships. Rethinking education means reflecting the FIR-inspired changes in the workplace, and one of the most important game changers in the future of business is flexibility.

Workers in the FIR era are in a challenging place, where society expects workers to work like machines, "programmed" by management to perform an exact number of tasks every hour. Its tasks for machines, done by humans only until technology advances far enough to replace the humans altogether. However, it is not all doom and gloom, as humans and machines are expected to collaborate to great effect. For example, autopilot did not put pilots out of jobs, but instead ushered in human-machine collaboration. 'Cobots' are increasingly popular in this scenario, so the resurgence of artisans in cities worldwide functions to prove that just because something can be automated, it does not mean it will be. In this scenario, no massive job losses are recorded. If anything, the FIR results in loses and gains, and some jobs are just transformed. Africa's susceptibility to technologically-driven labour market disruptions is mild. Complex manual jobs are expected to remain, and caregiving is hard to automate. The "creative economy" will upgrade and create jobs, as opposed to completely eliminating them. Additionally, most clean energy industries are also more labour intensive than fossil-fuel-driven ones.

As AI begins to disrupt employment, South Africa recalibrates the tertiary sector to integrate universities and TVET shifting to digital business models and unbundling traditional degree programmes into individual courses. Educational leaders invest heavily in building shared digital "experience platforms", with harmonised systems, to deliver courses and serve learners in a seamless and integrated way across the network. Because students, educators and industry experts are at the centre, metrics are changed to include learner acquisition, retention, satisfaction and lifetime value. Administrators and the executive play a peripheral role. Education 4.0 is a learner-centred approach and the mind-set is one of continuous learning, prioritising training and employability outcomes. Social inclusion is the priority and there is political will from leaders to reduce the costs of learning. Distributed Co-Creation (DCC) is

used to find new, unique ideas. This happens firstly through monetisation of the learning outcome co-created by the students (e.g. Duolingo), and secondly through monetisation by selling the content co-created by students, which is then used to pay them in return for the content. This is the rise of education that pays for itself. The best-case scenario creates a 'co-creation institution of learning'.

4.7.2 "Highway to Hell" – extreme case scenario

A line from the song graphically paints a hell bound path with no stop signs and no speed limit, towards a place many fear. This is nothing like the dot com bubble or the stock market crash of 2008, but a corporate-driven Skynet-like catastrophe on our doorstep. An evolution called singularity has arrived in 2030, and it is the year collective machine intelligence outwits humans, according to Ray Kurzweil. AI is the new super power and controls the world. Tech-preppers would have foreseen a war of all against all, and 2030 happens to be doomsday. The tech billionaires have been preparing for doomsday; what Silicon Valley's best have been preparing for is now a reality. The Apocalypse has come and they are in a tech survival-mode. Only the super-rich in bunkers somewhere in New Zealand have better chances of survival. Some humans will be on Mars in 2030 and that ushers in new telecommunications jobs, transportation management roles, data analytics jobs and product design jobs in an interplanetary era (Asfa-Wossen, 2018).

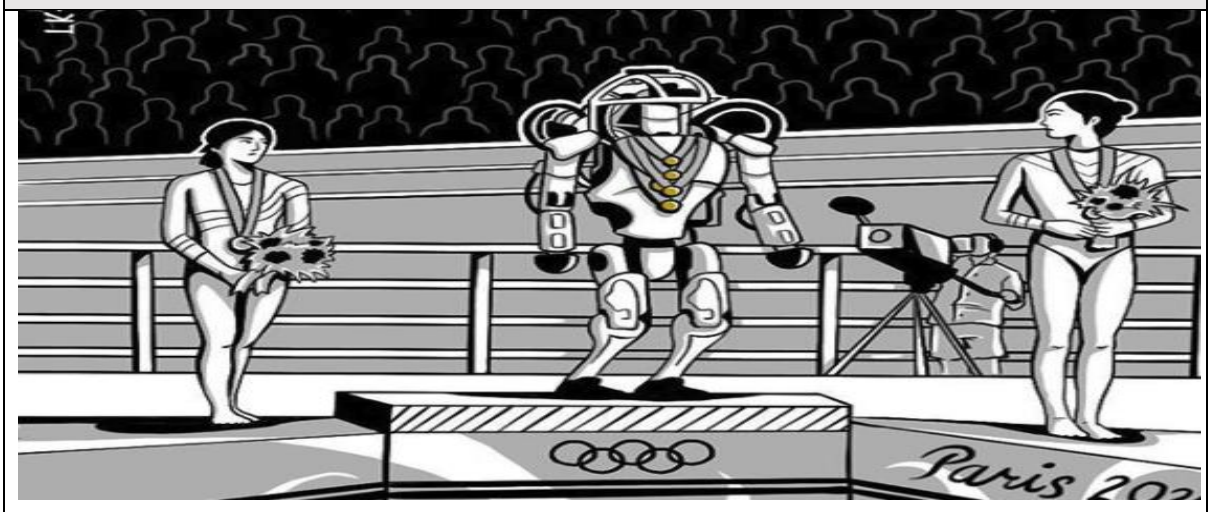
Mental illnesses are on the rise, as people are unable to cope with chronic unemployment and reduced wage, especially since the social security system is no longer existent. To make matters worse, humans trust AI more than they trust other humans (psychotherapists) and prefer to ask their most sensitive questions to machines rather than other humans. Mental health and counselling 'chatbots' that help depressed patients is big business, as humans respond better to non-judgemental, totally impartial inputs and conversation. Ellie the Avatar has been fully developed and backed by quantum computing, and is now capable of transmitting zettabytes and yottabytes. According to Salkever (2018), Ellie is the best psychiatrist, as she knows when and how to perform sympathetic gestures in response to the subject's verbal and facial cues.

Everything has been automated and humans have reverted to pre-Iron Age instincts for survival. Humans have been quarantined outside cities to facilitate ruralisation. Sources of clean water have been polluted and oxygen being regulated in the main cities. This is all

because government has lost control of the power grid, financial system and other essential services. Medical advances and certain infrastructure deteriorate, as AI does not become sick, (possibly only redundant), so existing hospitals eventually start to fall apart and there is nowhere else for sick humans to go. All one can do is sing in resignation, "I am on a high way to hell."

This period will have been precipitated by dismantler reign. A number of industries will peter out and dismantlers will be in high demand as a skilled workforce that performs this task in the least disruptive way. According to Frey (2011), the following will be in high demand: hospital and healthcare dismantlers, income tax system dismantlers, and so on. Since the role of education was to skill workers, education system dismantling would have taken place, as education is no longer important. The vicious cycle of poverty will persist and become unbreakable. Unemployment, lawlessness and loss of life will be the order of the day. The prison system will also be dismantled and 'amnesia surgeons' will take the role of doctors who are skilled in removing bad memories or destructive behaviour. Not only that, 'executioners' for virus-builders will be commonplace in the future. Virus-builders who get caught will have a choice: they can either go to the electric chair, or spend some quality time with the amnesia surgeon. This period is not about man working *with* machines, but man *versus* machine.

Figure 4.4: Man versus machine



Source: Futurism (n.d)

AIEd has unleashed Schumpeterian gale, alternatively known as creative destruction, which is the "process of industrial mutation that incessantly revolutionizes the economic structure from

within, incessantly destroying the old one, incessantly creating a new one" (Joseph Schumpeter, n.d). Educators have lost their traditional role to intelligent machines and those that remain are now classroom assistants. Formal degrees have lost relevance and the focus is on training serial entrepreneurs. In an entrepreneurial institute, robotics kits will be given to students to empower them to build and program their own robots and develop their design skills through an innovative online learning platform. Elitist education is the new normal, with no more generic courses applicable to all students, as teaching, carried out by emotionally sensitive machines, is highly personalised. A student will learn a variety of seemingly unrelated subjects in a form of holistic education that is specific to his or her goals. With public education gone, those affected by ruralisation will revert to first revolution learning of the basics of survival, including foraging, hunting, growing crops and building shelters (von Radowitz, 2017).

4.7.3 "Bat out of Hell" – the outlier scenario

"Bat out of Hell" suggests something moving recklessly fast. The idiom here is suited to the sudden appearance of unexpected disruption. **The disruptor tertiary institution** will meet the needs of those who say that the mass customisation enabled by Industry 4.0 is not enough. Consumers want more; they want mass personalisation, which can only be had when the human touch returns to manufacturing. Welcome to Industry 5.0, the "human touch" revolution, as Østergaard calls it. Actually, Industry 5.0 is not an incremental development from Industry 4.0. It is the end of automation, but an "end" that is, in fact, enabled at least in part by robotic automation. Futurists had predicted the emergence of trans-humans in 2050 (EC, 2016), but the disruptions brought about by *NBIC-convergence* enhances people's intelligence, mobility, cognitive qualities and industrial productivity. People's abilities will be augmented through technological implants, such as memory and energy storage, and learning will happen digitally in enhanced classrooms, virtual educational spaces and flexibly personalised teaching systems. Education establishments have acted on wearables' huge potential to revolutionise teaching and training of, and learning by, students. With Genetically Enhanced Humans (GEH), through implant techniques, the variations between humans and machines will become increasingly blurred. The enhancement implants will work to maximise students' tertiary learning results. People will not only settle for wearable computing, but embedded computing.

In this scenario, the 'quantified self' will be the common currency for education. "Through technology we are engineering our lives and bodies to be more quantifiable," says Kevin Kelly (2012). Through sensors and Internet of Everything devices, we are able to measure accurately all of the input and output of the human body. Big data is the new crude oil and AI is having the impact of electricity, so we either become AI or become controlled by it. The disruptor tertiary institution will have a system capable of measuring our mental capabilities, monitoring thousands of different categories of skills, knowledge, attributes and characteristics. Larry Page predicted that "in the future, Google's software will be able to understand what you're knowledgeable about and what you're not". The "Bat out of Hell" disruption has brought changes that will allow students and workers to connect themselves to some sort of brain scanner and instantly know what jobs they are qualified for, and what skills they are lacking. Instead of sending a CV, prospective employers will require a copy of the latest brain scan.

The disruptor institution of learning will take the form of 'a transformed corporate university', where corporate education has usurped traditional universities. University degrees are almost obsolete in some industries. The Googles and Amazons of 2030 have a monopoly on the technology required to genetically modify people and create 'professional triathletes'. Work-based learning is now important from a young age, and those that pay well – the Googles and Amazons, no doubt – will attract the best students. Gene therapy has become as easy to acquire as a flu shot. Octogenarian Service Providers are mushrooming and active geriatrics will provide a demand for goods and services currently not being addressed in today's marketplace. This means that the curriculum will be almost unrecognisable relative to 2030 studies. This future image is not about preparing only doctors, firefighters etc. It involves a lot of unique new careers, such as drone pilots, healthcare robot managers, outer space tour guides, 3D printer clothing designers, computer hacker anti-hackers and smart highway traffic managers. To appreciate the role trans-humans will play, one needs to understand that an average 30-year-old person in the US will have worked 11 different jobs. Fast-forward to 2030, the average 30-year-old person will have worked 200-300 different projects. This is where corporate education institution, with its focus on lifelong learning, comes in to offer personal experience and official trainings.

The government has allowed for privatisation of education to drive competition and efficiency. Hostile takeovers of universities by conglomerates follow and corporate education is the only

viable option. The landscape for tertiary education has been disrupted. AI and automation displace professional jobs, portfolios of skills are more important than university degrees as prerequisite for jobs, and the labour market structure has shifted to more freelancers than full-time employees. A closer collaboration between tertiary education and industry would facilitate a smoother transition between both environments. MOOC certificates jointly offered by both academia and industry are an alternative to traditional academic degrees. In fact, non-academic certificates will be ubiquitous. Continuous learners and their preferences for on-demand micro-certificates dominate as technology disrupts the workplace. Year 2030 may require a tertiary graduate-level education for 60% of all jobs, but it will not be a four-year degree. I envisage multi-course specialisations and teaching critical industry skills in cooperation with leading industry employers. For each student, AI will know when skills are deficient, what is needed to boost them and when they have mastered the topic. Throughout this training curve, individual learning will begin to scale far faster, so much so that completing a four-year degree in 1-2 months will be entirely possible with this form of AI learning systems.

4.7.4 "Still Raining" - it is 'business as usual'

A folk tale is told…

Chris is a man who, after a 100-year slumber, wakes up to shudder in horror at what he sees in the 21st century. People are talking to small devices fastened to their ears. Kids are in the lounge, moving miniature athletes around on electronic screens. The elderly bounce around with metronomes in their chests and 3D printed hips. Airports, health facilities, stadiums, malls…every place Chris goes, he is bewildered. Then he enters a schoolroom. The old man knows exactly where he is and exclaims, "This is a school, we used to have blackboards in the 1900s, only now they are white!"

Jimi Hendrix captures the notion of 'business as usual', saying, "lay back and groove on a rainy day, still raining, still dreaming". It is the 'same old thing'. All the studies I have read, including futurist studies, agree that the university and its campus structures are not going anywhere. HE education seems immune to a shakeout. Changing demographic trends, rising costs, lacklustre job markets and an ill-prepared workforce are not doing anything to force the tertiary institutions to change their business model. Another challenge is the vested interest in keeping the status quo, particularly on the part of tertiary education institutions that have not yet

embraced the opportunities offered by digital education. Of course, some universities will close down, some will downsize and some will even merge, but the system that started in Bologna is so entrenched. If anything, the tertiary education sector in South Africa has continued to operate as if the FIR is non-existent. It is sad that leaders in the country presiding over an education system incapable of reducing skills mismatch seem to operate with an "if it ain't broke, why fix it?" mentality. The country has remained stagnant and some experts even believe the nation to be regressing as far as the provision of skilled and productive labour is concerned.

It is the year 2030, the National Development Plan has failed to achieve 80% of its goals, and the public and private sector continue to move with no clear plan of action on how to incorporate the FIR into the economy and society. The curricula that was identified to bring the STEM skills through the educational ranks has not been implemented, resulting in the country being 'behind the curve' in comparison with its African and global counterparts. South Africa still lags behind other upper middle-income countries participating in tertiary education. There are backlogs in improving access for poor students to tertiary education, and participation rates still show large racial differentials. South Africa's inability to implement its well-crafted policies is once again evident for all to see. A student with a PhD in sociology may learn everything about social conflict, but have no real-world tools to create or implement solutions.

Everything is changing, but tertiary institutions are not giving the students what they need. Lecture was, and still is, king. Though ineffective, students and workers expect to be spoon-fed through a lecture. More so, employers are still relying on outdated hiring models and recruitment, which means graduates will not have the right frame of mind needed to continually maintain their skills. "Sixty-five percent of the class of 2030 will work in jobs that are yet to exist today" (WEF, 2016). Organisations need to create specialised work environments for jobs that do not yet exist, in sectors that have not yet been created. A large portion of core academic curriculum content is already obsolete by the time students graduate. Tertiary education really needs to move with the times. The contemporary educational system, which is suited to an industrial model, is no longer working; an overhaul of education is a long overdue. Students who graduate from our TVET continue to solve old problems as a peg in an old system, because they were not taught how to critically analyse the industry. Instead, the system needs to equip 2030 workers to become more entrepreneurial, sacrificing neither the strategic nor the tactical.

On the other side of the coin, there are positives brought about by disruptive innovation. In line with the global rise of online platform work, Sub-Saharan Africa is also cashing in on the new work formats. Of note are the 56 e-ridesharing services on the continent, most of them local apps launched over the last three years (TechCabal, 2016). These African companies should put strategies in place to manage and integrate a distributed, virtual workforce, and to mitigate the challenges of engaging in online work (WEF, 2017c). Online learning is a disruptive technology that is making tertiary institutions reconsider their higher education models. With government institutionalising free education and wanting to compete globally, they may pour billions into helping educators 'ride the wave' that is disrupting education. This would only begin in 2030, where educational leaders will start to anticipate emerging skills needs and adapt policies accordingly.

4.7.5 Summary of the key manifestations

Table 4.9: Four scenarios for skills transformations in the South African tertiary institution towards 2030 – summary of the key manifestations

	Stairway to Heaven	**Highway to Hell**	**Bat out of Hell**	**Still Raining**
General	The FIR results in losses and gains, and some jobs are transformed, but no major job losses. The creative economy upgrades and creates jobs.	Corporate-driven, Skynet-like catastrophe. AI is the new super power and controls the world. Everything is automated, leading to a vicious cycle of poverty.	NBIC-convergence results in Genetically Enhanced Humans (GEH). Gene therapy is as common as a flu shot. Labour market is mainly freelancers.	NDP 2030 goals not achieved. South Africa is stagnant, with no clear plan on how to incorporate the FIR into the economy and society.
Human-machine relationship	**Man working with machine**. 'Robots do not need to apply', because education is able to breed (future-proof) the workforce.	**Man vs machine.** 'Robots do not need to apply', because they are guaranteed jobs, as virtually all jobs have been automated.	**Man is the machine.** Humans and AI working hand in hand. Implant techniques blur, variations between men and machines.	**Man dominates machine**. 'Robots do not need to apply', because the economy is stuck in the 3IR and only a few jobs have been automated.
Actors in skills policy	Communities, industry, chambers of commerce, DHET, schools, alumni	Corporate sector, NGOs	Conglomerates	State, trade unions, SETA, universities, colleges
Business model	The FIR is embraced, leading to a **co-creative institute**. Tertiary sector is recalibrated to integrate universities and TVET shifting to blended/digital business models and multiplex degrees with apprenticeship.	AI is mainstream, leading to public education collapse and the rise of elitist **AIEd.** Fragmented micro certifications outside university circles using digital business models.	**Disruptor institute** will take the form of corporate education offering personal experience and official trainings. The quantified self is the common currency for education.	**Current state** where elite universities dominate and TVET is stigmatised. Specialisation degrees/diplomas. Digital education not yet embraced.

Prerequisites	Relevant skills and job readiness are vital. Industry offers skills application places and collaborates on research. Education reflecting the FIR-inspired changes in the workplace**. Adaptability learning.**	Entrepreneurial and cyber skills are vital. There is a high demand for dismantlers that perform this task in the least disruptive way. **Just for you learning.**	Portfolios of skills are more important than degrees as prerequisites for jobs. Work-based learning is now important from a young age. **Just-in-time learning.**	Accredited education is important. Skills not a priority because the FIR has not taken hold yet. **Learning for one career.**
Role of government	Government ensures minimum standards, a minimal role in the area of policy and regulation to restructure tertiary education.	Government has lost control and capitalism is dead, resulting in deregulation of the industries.	The government has privatised education to drive competition and efficiency, and hostile takeovers by conglomerates follow.	Hands-on government prioritises access. Transformation through legislation and funding.
Technology	The FIR rules. Partial AI and IOE leading to experiential learning delivered across technology-enabled platforms. **Blended.**	FIR rules. Technology disrupts traditional university models and AIEd is ubiquitous. D**igital screen.**	Industry 5.0 rules. People's abilities augmented through tech-implants. **Virtual educational spaces**.	Industry 3.0 rules. AI only a niche. **Face-to- face.**
Calibre of learner	Lifelong learner	Mainly young people	Continuous learner	Mainly matriculants

4.8 CONCLUSION

The four alternative scenarios developed in this chapter are for assisting South African tertiary education institutions to anticipate and adapt to the challenges confronting them, while also seizing the opportunities that emerge to make a meaningful contribution to sustainable, broad-based prosperity and progress. There is a chance that any of the scenarios can happen, as they are informed by an improved understanding of the factors that will influence tertiary education in the years leading up to 2030. Government needs to support the change of curriculum to reflect this new world. A harmonised, multi-stakeholder approach is the answer, which will pave the way to tertiary education embracing Industry 4.0 and Education 4.0. The campus of the future can become a creative hub, where partners come together to serve traditional and non-traditional students.

It is, however, critical that all stakeholders engaged in skills development prepare for the eventuality of any of these scenarios and ponder even the most unlikely events that may occur to shape the future. Futures Studies is grounded in the uncertainty of futures, and the scenarios are very unlikely to pan out in the exact fashion described above. One thing that should not be

ignored is the effect of technology and future jobs on education in its effort to prepare people for a world where the most adaptable will survive. As a result, this will occupy the mind of the researcher in the formulation of the “tertiary education institution of the future towards 2030”. The next chapter will seek to present an idyllic, realisable future for tertiary education skills transformation in South Africa, through a vision and set of contextually-aligned, useful recommendations.

CHAPTER 5

TRANSFORMING THE FUTURE

5.1 INTRODUCTION

By mapping the past, present and future, understanding future issues and their impact, being cognisant of the major drivers of change, deepening our analysis through CLA, forming possible futures, and selecting a desired future and back-casting ways to realise it, we can craft the future in which we wish to live (Inayatullah, 2008). There are alternative futures of varying likelihood, and in all probability, no one can be certain that a particular future will occur. The mere fact that the future only exist in our imaginations renders it impossible to plan for only a single future. Rather, it is incumbent upon us to plan for the variety of ways in which the future could unfold (Adendorff, 2015).

In the previous chapter, the development of four plausible scenarios provided a basis for expanding the future of tertiary education in South Africa. A transformative dimension, according to Inayatullah (2009) calls for deconstruction leading to an investigation of possible futures and the creation of preferred futures. This process is possible because CLA accepts all perspectives as valid – by examining various (and often opposing) views, it is possible to see how the tertiary institution has been defined more by perceptions and myth rather than reality (Conway, 2012). In the case that visions of the future are conflicting, the best way forward is neither a compromise nor a withdrawal, but in finding win-win solutions. A day in 2030 is not a fixed destination, but a future with multiple and evolving scenarios. In addition to shining light on the future of education, these scenarios also meet the challenges faced by institutions head on in an effort to provide skills transformation.

The main thrust of Chapter 5 concerns the transformation of the futures. The sixth pillar transforms through developing a distinct preferred future, which dovetails with a preferred scenario. The desired future flows from scenarios. The future can be narrowed toward the preferred through a process of questioning and agile experimentation (Inayatullah, 2005). It is of great import to consider a desired future for all South African stakeholders. This research embraces the attitude that a positive, hopeful future can be carved and crystallised by the current actions of all South African stakeholders wanting skills transformation. This is in line

with models of social change mentioned in the second chapter, which unearths and lays down diverse alternatives to improve uncertainty planning for South Africans' skills transformation leading up to 2030.

Additionally, Chapter 5 provides proposed solutions to the research questions highlighted in this study, with the ultimate aim of addressing the research objective as envisaged at the start. Lastly, the chapter will strive to provide recommendations and conclusions to the questions raised by this research.

5.2 USES OF THE FUTURE

The power of knowing through questioning has been critical throughout this research. The departure point was finding out the status of tertiary education, followed by investigating a likely trajectory if the sector continues on the same road. A perfect forecast or vision is non-existent and, as a result, the future is continuously revisited and questioned (Inayatullah, 2007). The real value of all futures activities, from forecasts to visioning, is not in the future, but in the present. The activities can shape peoples' perceptions, bring awareness of dangers and opportunities ahead, spur people into action, coerce them into be creative, embolden them into social action, paralyse them with fear, exclude them, or tell them that they themselves, their cultures and belief systems are relevant or irrelevant (Sardar, 2010).

Futures thinking grounded in foresight training can assist staff and their institutions with novel capabilities and skills on the level of litany. At a deeper level, futures thinking is applied in this research study to create capacity and help in the creation of more effective business strategies and innovative educational solutions for skills transformation. Through understanding the alternative, used and disowned futures, educational institutions and augmenting stakeholders can become far more creative and proactive in creating the desired future of education for South Africa.

5.3 CREATING THE FUTURE

To bring transformation into the present and design the future that embraces skills transformation, it is invaluable to interrogate the roles and choices that stakeholders of the educational sector make in determining the preferred future. The approach of this research

makes it clear that, as the new world of work transpires, policymakers, students, labour, educational leaders, captains of industry and workers must proactively manage the workforce transitions. The focal issue is to discover the appropriate tools that will establish the confidence necessary to create the preferred future for skills transformation in tertiary institutions. This research has laid a platform for co-creation with various stakeholders in an effort to visualise a tertiary institution that contributes to skills development.

To help the creation of the South African tertiary education institution of the future, strategies are reviewed and proposed. These strategies provide a foundation for the development of the "future vision of the tertiary education institution for skills transformation in South Africa towards 2030". Some questions that need to be asked about the decisions that will see the desired future realised include:

- What does a future-ready education mean?
- What are the implications of embracing Education 4.0 and the FIR for the key stakeholders?
- What measures should be put in place today to prepare students for the future of work?
- What infrastructural and policy changes are needed to ensure the adoption of an education system that caters for skills transformation?

The recommended "future vision of the tertiary education institution towards 2030" encapsulates an attainable, realistic and desirable future for the propagation and improvement of skills in the South African context. Out of the four scenarios developed in the previous chapter, the "Stairway to Heaven" scenario is the most positive. It supplies a future in which all stakeholders approve of and embrace the mandate of providing relevant skills and job readiness in a fast changing world, and the benefits are maximised for all involved through co-creation. It is a scenario where industry, tertiary institutions and society have decided that the purpose of education should be lifelong learning for a viable, productive and sustainable world. Furthermore, the scenario provides some insight on the vital measures required to embrace the innovation and the appropriate pedagogy.

5.4 IDEATION OF THE PREFERRED FUTURE

Futures Studies makes room for many possible futures (Inayatullah, 2012), but which future image will come to fruition? This question is not worth asking. The right question is: which future does my tertiary institution prefer to create? Also important is to find out the availability of support (resources and values) needed to create this preferred future. This research proposed a "co-creation institution of learning" as an idealistic scenario. The preferred future envisaged in this study has no room for an additive, cumulative and archival knowledge acquisition type of education. As Herman Kahn (as cited in Conrady & Buck, 2011) says, "Everybody can learn from the past. Today it is important to learn from the future." It is essential for planners to comprehensively grasp possible future developments so that they can prepare for them. As strategies, Education 2.0 and Education 3.0 are retrospective in nature, focusing on "what should be known?" Alternatively, the transformed tertiary education is a prospective strategy that enables individuals to act strategically under conditions of uncertainty, hinging on the common paradigm of "what should one be able to do?" A transformational education marks a new culture of education and a new direction in teaching and learning of content and methods. This includes incorporating central issues of sustainable development into tertiary education and supporting the acquisition of competencies that enable people to live and act in a sustainable way (Dannenberg & Grapentin, 2016).

In this scenario, the FIR and Education 4.0 are complete and successful by the year 2030. Additionally, most of the NDP 2030 goals have been met and the government is about to announce Project 2050. The desired future of the tertiary education institution in South Africa is because of co-creation with government, industry, students and society. Government has realised that its bureaucracy and failure to understand disruptive technologies were hindering skills development and, as a result, has settled for creating a conducive environment for all stakeholders and fostering a culture that supports lifelong learning. Using the Programme for International Student Assessment (PISA), the World Bank calculated that a year of education in South Africa is currently worth only about 60% as much as one in Singapore (*Economist*, 2018). However, come 2030, South Africa's education is on par with Singapore's, and skills needs information is being used to inform curriculum development and tertiary education programmes. This includes assessments of existing and future skills needs and other types of labour market information. Partnerships with industry has allowed work-based learning to play a vital role in providing competencies needed to successfully obtain and keep jobs. TVET

provides institution-based training programmes and companies supplement apprenticeships, mentoring, internships, traineeships and work-experience programmes. To prepare students, CHE and education policymakers are committed to equipping learners for a complex and technology-driven future. Moreover, they are always searching for ways to increase flexibility for those seeking to provide students with learning experiences that are more competency-based, more project-based and more attached to the real world. Members of parliament and policymakers have furnished a clear policy and public case for the critical role of tertiary education in building an agile, adaptive and relevant workforce of the future. Given the complexity of the change management needed, competing for talent is no longer viable. Rather, collaboration on talent issues is now the way to go. Businesses are teaming up with industry partners to design a future skills plan, pooling resources where appropriate to maximise benefits, and working more closely with government to map a future view of skills demand versus supply.

The older generation leaders who resisted change have either been fast-tracked into retirement or have awoken to the fact that the future is very unforgiving, comprising "rapid knowledge obsolescence". This means that lifelong education and just-in-time knowledge are necessary for people who want stay relevant in the employment world. Not only that, unlearning is also a crucial part of the professional development of teachers, administrators and policymakers. Politicians, bureaucrats and educationists who were bent on transforming existing universities through redress have changed their minds after investigations revealed wider and deeper potential consequences. Digital education has furnished the government with a chance to accelerate outreach, to ensure equal access to and quality of education so much that 'demographically representative' bodies of students and staff emerge organically. The 2030 preferred future of education postulates viewing future education as truly transformative by accepting that digital learning technologies may be better at transmitting information, thus allowing educators to do their job of helping students transform knowledge.

Tertiary institutions are collaborating with industry to provide students with hands-on experiences. Focus on jobs is leading to specialising for generalists. There is the swapping rote-learning tests with more opportunities to do meaningful work. The classification of knowledge into Humanities, Social Sciences, Natural Sciences and Formal Sciences is eradicated, because it paves way for specialisation. Multidisciplinary and interdisciplinary pedagogies are slowly replacing silo education because of their ability to give a fresh

perspective on existing problems, as well as to solve challenges using truly innovative solutions. The answer to a sustainable and viable future would have remained elusive as long as competencies to successfully handle difficult and unfamiliar situations were not inculcated in education. This preferred sustainable future is based on certain key competencies being part of tertiary education teaching and learning. Institutions are now teaching the skills necessary to advance successfully in a globalised world, while also growing resilience in their students, faculty and staff towards ecological issues and cultural diversity. In short, this is a sustainable quality of living. Key competencies required to turn around unsustainable living means curricula have included trans-disciplinarity, participation, problem-orientation and the mixing of formal and informal learning. South Africa has also developed an instrument that measures skills in critical thinking, complex analysis and other nuanced skills. Furthermore, the progress in tertiary institutions makes it possible to test the validity and reliability of the test instrument's results.

In reality, 2030 will need wide-ranging skills, because the organisations and the approaches to work of tomorrow will be different. Career guidance is no longer about encouraging a student to select a "job for life". On the contrary, it focuses on equipping individuals with the skills to navigate a changing world of work. "Jobs for life" are history and so is safe employment, which is giving way to independent work in the form of freelancing, self-employment, portfolio work and the gig economy. Co-creative education is now helping students cultivate the self-motivation that is needed to help prevent floundering in a gig economy. Self-direction has overtaken work ethic, which is a 20th century concept. In the 21st century, every individual must be able to independently direct their own work, wherever they sit in the organisation, or whatever context they are in (Ark, 2018). The future worker toolbox will be well-armoured if people have been taught how to thrive in a state of constant change.

The best-case scenario is not waiting for disruptive technologies to force institutions to change. If anything, the envisaged scenario of AI obliterating jobs has not happened. The proportion of work actually displaced by 2030 is lower than previously envisaged. Of course, adopting new technologies is only a small piece of the puzzle; these tertiary institutions are now working with their staff to change institutional culture. Disruptive technologies are allowing institutions to pivot from the acquisition of knowledge to the application of learning. Government is pushing for Internet of Everything (IoE) development and it will not only benefit South Africa in terms of infrastructure, but it will also prepare students for the future. Cybersecurity

Ventures (2017) anticipate 6 million jobs in global information security by 2019, and tens of millions more by 2030. Applications of IoE is revolutionising campus life, including safety and efficiency. The deployment of sensors has the effect of lowering energy consumption and improving connectivity. The IoE is being used to enable remote management, status monitoring, tracking and alerts. Government departments and tertiary education institutions applying IoE capabilities are thus leveraging data to streamline processes and promote sustainability. The data on student learning and campus activity from connected devices will inform the direction of content delivery and organisational strategy.

5.5 SOUTH AFRICA'S TERTIARY EDUCATION INSTITUTE FUTURE VISION

The desired future of tertiary education is set against a backdrop of public and private sector collaboration and transformation, with the aim of turning the nation into an excellent hub for skills transformation. Equally important are sound institutions, good infrastructure, macroeconomic stability and quality basic education. The theme highlighted in Chapter 4 asserts that automation will create more jobs, rather than mass unemployment, as long as we guide innovation responsibly. To achieve good outcomes, policymakers and business leaders will need to embrace automation's benefits and deal with techno-driven worker transitions, including mid-career job training, enhancing labour market dynamism and enabling worker redeployment. This broad transformation will challenge contemporary educational and employee training models, as well as business methods for skills development. The vision must accept that the South African jobs and skills historical profile is different from that of industrialised countries. Alternatively, the nation should respond to the double-barrelled challenge of participating in a high skills globally competitive environment, as well as a local context that creates low-wage, blue-collar jobs to absorb the large numbers who are unemployed. Steered by the principles and strategic fundamentals identified and discussed earlier, the "future vision of the tertiary education institution in South Africa towards 2030" can be formulated and presented.

5.5.1 Leading strategic change

The desired future requires us to imagine a future where industry is working with tertiary institutions so that these institutions create graduates prepared for the jobs that businesses have for them. It signals a vision that builds on students' strengths and provides an 'incubatorial'

environment for their talents to flourish. It is high time that leadership realises that all South Africans need higher education. The year 2030 is not a period where some will need an education while others will not. It is time for education to lead again and change the culture that resists innovation and continuous learning. It is time for strategic leadership to "eat culture for breakfast". After all, technology does not care about culture; it keeps on disrupting. Only a bold leadership stance will align all education with future work. The preferred future should act as an informer for what to learn and how to learn it. Putting the future front and centre in education will ensure a future-ready generation, equipped with the skills they need now and which will sustain them as the future of work transforms. The unprecedented immensity and tempo of transformation means that the future is approaching at full tilt. If the "future vision of the tertiary education institution in South Africa towards 2030" is to be realised, there is no room for complacency on the part of educational leaders. The leadership has no option but to reposition and optimise the tertiary education business model by converging with industry and exploring disruptive new business models. This vision supports the development of a practical and lasting tertiary strategy, collaborated on and sanctioned by all stakeholders, and delivering clear guidance for sustainable skills development in South Africa.

The future-ready tertiary education strategy will consist of programmes that undertake to deliver on the following:

- Learning outcomes that produce "professional triathletes" needed in the FIR workforce.
- Embracing Education 4.0 that will redefine what it means to be prepared for the future.
- Pursuing a holistic approach for skills needed for the planet, people and profit.
- Meeting the rise in non-traditional students with creating a culture of lifelong learning.
- The collaboration and involvement of all stakeholders in addressing occupational mismatch.
- Stronger co-ordination between growth and industrial policies and skills policies.
- Probing skills mismatch and putting action plans in place.
- Enhancing the capacity of TVET to deliver skills training linked to the labour market.

5.5.2 Embracing Industry 4.0 and innovation

The image of the future as determined by the FIR is a desired future, which refutes the borrowed future that has been failing to produce the desired results. A transformed tertiary education refuses to remain locked into an image from the agricultural and industrial era and stakes its place in alternative futures. Alternative futures create adaptability and help stakeholders involved to embrace uncertainty with confidence. At tertiary level education, the used future that repeatedly emerges is the disconnection between the new technologies and the design of classrooms in strict rows, as informed by the deep worldview of the factory. Although the factory model might have worked a century ago (in developing obedient workers), this is not the case in a critical skill dominated knowledge economy. In order to improve competitiveness, the country needs to institute a technological readiness pillar, which measures the agility with which an economy adopts existing technologies to enhance the productivity of its industry, especially its capacity to fully leverage ICTs in daily activities and production processes. Through innovation, the "future vision of the tertiary education institution in South Africa towards 2030" seeks to add value and develop premium products and processes to maintain a competitive edge.

5.5.3 Embracing Education 4.0

It is important to consider that basic education in South Africa has not been producing independent, critical thinkers who are ready to take responsibility for their own learning. In this vision, quality tertiary education is crucial for the South African economy to scale up the value chain beyond mere production processes and products. "Future vision of the tertiary education institution in South Africa towards 2030" puts students at the centre by taking into consideration changing student characteristics, changing student expectations and changing perceptions about the value of formal education. Education 4.0 empowers a student to structure his or her individual path with complete flexibility, and affords the freedom to aspire, approach and achieve personal goals by choice. TVET and universities will become hubs of social interaction, engagement, collaboration and recreation that interface with their local communities. This not only means focusing on the current and future needs of the student, but everywhere and anytime learning. In the vision, a paradigm shift is necessary, in terms of what the institutions should do or what and how students learn, among other things.

5.5.4 Embracing sustainability

A sustainable "future vision of the tertiary education institution in South Africa towards 2030" should include envisioning, critical thinking and mindfulness, systemic thinking, promoting partnerships and involvement in decision-making. The vision seeks to advance policy that will anchor ESD in curricula and quality standards, and cause systemic changes. Sustainable education is future-oriented and focuses on competencies that are crucial for understanding the key challenges of the society. Once the competencies are part of tertiary education settings, they can be measured as the aspired outcomes of education. It is not simply about a content-related focus on ESD, but about setting an example and practicing sustainability in order to facilitate the transfer into everyday life. The programmes instituted by the vision will build knowledge, values and skills, which are essential to participate in and contribute to reaching a more sustainable future.

5.5.5 Championing a skilled workforce

The skills required in the Fourth Industrial Revolution world should also meet the aspirations of our Generation 'Z', who are growing up in a time of revolutionising technology. This generation longs for growth, and relevant and meaningful education to equip them for future jobs. In this vision, we need programmes that will consistently retrain people, because the future of work will be synonymous with "the survival of the most adaptable". In fact, the future lies in the person who holds the job and there is no future in any job. This future vision will ensure that a person entering the workforce in 2030 is better prepared to reboot their career six times throughout their working life. Consequently, micro colleges will spring up in thousands of different categories to prepare learners for jobs that do not yet exist, envisaging technology that has not yet been invented, in an effort to prepare them to solve problems we do not even know are problems yet. Incentivising innovation is a priority, but laying the foundations for long-term, sustainable growth requires public-private collaboration to work on long-term competitiveness agendas. The next-generation digital learning environments created by the future will nurture learning and engagement, collaboration and community in a way that is both scalable and sustainable.

A discussion of the "future vision of the tertiary education institution in South Africa towards 2030" was preceded by reviewing the preferred scenario, and marks the completion of the six pillars. The rest of this chapter will be dedicated to an examination of whether the research questions and research objectives have been answered and achieved, a review of the problem statement, as well as the contribution of the research and conclusions, recommendations for the future of the tertiary education institution in South Africa, and some practical guidelines to address the strategic issues of the tertiary education institution of the future vision.

5.6 REFLECTIONS

Predicting the future is proving to be extremely difficult today; we will get the "future we deserve" if preparations are not in place. Using Peter Drucker's words, "the best way to predict the future is to create it." Futures thinking and exploration must be ongoing and institutionalised into normal planning and policy-making in order to provide lasting benefits. Once foresight becomes 'business as usual', tertiary education institutions will be able to imagine a longer-term perspective, reconnoitre major uncertainties and potential surprises, keep up with rapid change, foresee unintended results and shape a preferred future (Olson et al., 2015).

The challenges of educational mismatch, lack of soft skills and low productivity have raised the need for collaboration and involvement from students, workers, business and government. As education and training play a critical role in labour market imbalances, a well-functioning tertiary education incorporating continuous education and training is the solution to skills mismatch. However, the real problems in tertiary education are usually not considered, while the 'hyped tech' takes centre stage, as if technology caused these problems. Technology is not a silver bullet. *People* create the future – not change, not technology. Ultimately, the most critical technological breakthroughs will be those that free up the workers at institutions so that they can better serve learners. One day humans may create machines that are capable of emulating human cognition (neuromorphic computing), but to avoid a scenario where "my bot will contact your bot to finalise the deal", South Africa needs future-ready Education 4.0. Is Education 4.0 critical for the successful implementation of the FIR? The preferred vision not only answers the question, but also provides answers to those who see the FIR as irreversible in South Africa. It looks to education to provide the necessary skills and knowledge. The most urgent issue is how we create the conditions necessary to reignite growth and create a South

Africa that is more prosperous and inclusive for all. The idea is to increase South Africa's per capita income to parallel most industrialised countries through acquiring and using knowledge.

5.7 CONSIDERING THE PROBLEM STATEMENT, RESEARCH QUESTIONS AND RESEARCH OBJECTIVES

The **problem statement**, formulated in 1.2 above, contended that current tertiary institutions were failing to prepare workers to succeed in the FIR. Additionally, consideration was given to the fact that organisations are not going to protect *jobs*, but by investing in adaptability, re-skilling will surely protect the *people*. Developing quality workers is a massive prerequisite for economic transformation. This research intended to create new insight and understanding concerning the tertiary education institution in South Africa in the years leading up to 2030, through the design and formulation of scenarios for skills transformation.

The **primary objective**, as stated in 1.3.1 above, was to improve the readiness of South Africa's tertiary education institutions by gaining an understanding of the drivers of change that will lead to the development of alternative future scenarios, including the identification of their desired future leading up to 2030. The realisation of the primary objective was achieved through establishing co-creative strategies that prioritise skills and sustainability for tertiary education institutions to embrace. One of the aims of this research was to provide the main stakeholders with actionable yet progressive ideas on how to address skills mismatch crippling South Africa.

The **research methodology** used in this research was comprised of Inayatullah's Six Pillars of Futures Studies, in which emphasis was placed on scenario planning and the creation of alternative scenarios for the tertiary education institutions in South Africa towards 2030. Deepening of the future was done through CLA to facilitate the discerning of issues from various viewpoints in the creation and expansion of transformative stories.

The **secondary research objectives**, in Table 5.1 below, related to certain factors that were considered in determining South Africa's tertiary education readiness for skills transformation.

Table 5.1: Secondary research objectives	
RO_1	To analyse the drivers for change in the global tertiary education trends towards 2030
RO_2	To conduct an in-depth analysis of education within the FIR and establish whether the FIR is dictating what should be taught and how it should be done
RO_3	To consider emerging threats and opportunities that will influence the future of education by plotting various alternative futures in accordance with specific drivers
RO_4	To analyse factors that impede the implementation of plausible futures for South African tertiary education institutions
RO_5	To gain a better understanding of the best possible future for South Africa
RO_6	To analyse South Africa's progress and failure in terms of skills transformation in institutions of learning
RO_7	To develop a set of recommendations to meet future skills needs

Dovetailing with the objectives discussed above, the study formulated research questions to support the objectives of the research. The research study made an effort to create strategies illustrating how South Africa can adapt to the challenges it faces by embracing a future-ready education. The **research questions** for this study were articulated, incorporated and addressed in order to underpin the research, thereby ensuring the attainment of the research objectives. The synthesis results in the full appreciation of the research objectives and questions, as the researcher was able to provide alternative explanations as to what is really happening.

Table 5.2: Secondary research questions	
RQ_1	What are the drivers of change in determining the future of education in South Africa and globally?
RQ_2	What are the consequences for not embracing the education of the future?
RQ_3	Which role-players should be involved in the determination of future skills?
RQ_4	In what ways might the future of South Africa's tertiary education be transformed?
RQ_5	What approaches could be adopted to envision a preferred future for the South African tertiary education institution?
RQ_6	What are the possible, plausible and preferred futures for South African tertiary education towards 2030?

A comprehensive image of a skills-focused tertiary institution was created, thanks to the application of scenario design and development as tools, including supporting the various stakeholders in identifying and adjusting to the kaleidoscopic environment. Scenarios expose decision-makers to rich possibilities they would otherwise ignore or consider unthinkable. Therefore, studying the future is not a futile exercise, but one that widens intellectual horizons and brings awareness of factors outside of leaders' concerns that may represent an opportunity or a threat. Scenario planning was used to enhance understanding and cultivate insight into the extensive implications of the issues and driving forces influencing tertiary education. This method makes room for all stakeholders to see diverse plausible futures. These fashioned scenarios formed the groundwork of a "future vision of the tertiary education institution in South Africa towards 2030" and, thus, the desired future.

The objective of this research is to aid tertiary education institutions (through the scenario-building process) in advancing futures and complexity thinking to better anticipate, respond to and proactively shape the key drivers of change as we advance towards 2030. In the "future vision of the tertiary education institution in South Africa towards 2030", the tertiary education has been transformed, through co-creation, innovation, collaboration with industry, embracing Education 4.0 and taking into consideration the needs of all stakeholders. This tertiary education transformation is based on:

- The co-creative ability of different stakeholders to reduce skills mismatch.
- Better co-operation, communication and striving for a shared vision and future.
- A holistic approach for skills needed for the planet, people and profit (SDGs).
- The introduction of Education 4.0 to meet the needs of the student and future worker.
- Future-ready curriculum that provides skills to operate in the FIR.
- Creating a culture of lifelong learning.
- Improved governance, accountability and quality in institutions.
- The enactment of a stable labour context through radical social and labour programmes.

The primary objective of this research was therefore achieved through alternative scenarios to formulate a "future vision of the South Africa tertiary education institution towards 2030".

5.9 RELEVANCE AND CONTRIBUTION OF THE RESEARCH

South Africa's main impediment to sustainable job creation is the structural mismatch between labour demand and supply, and failure to tackle skills. This could lead to political and social unrest. This research helps South Africans to accept the transformation of institutions for reskilling to enhance productivity and promote innovation-driven growth. This research offers solutions on how institutions can prepare students for future jobs, especially considering that holding a job for life in the 21st century is not an option. The relevance of such a study is only increasing since the FIR and AI are delivering huge changes to work, education and the way people live. Increasingly, there is need for improved management and strategies from all stakeholders to embrace future-oriented education that engages students and equips them with knowledge and skills for the future.

The role of the research was to add theoretical, methodological and practical value:

- Theoretical value: the use of futures thinking concepts and Six Pillars methodology, including CLA, scenario planning and strategic visioning was based on a review and examination of various literature resources. The aim was to add to the existing pool of knowledge through the comprehensive combination of these futures approaches.
- Methodological value: the research reflected on the future of the tertiary education institution in a South African context by using the Six Pillars method and framework of Futures Studies. Thus, a set of scenarios applicable to the future of the tertiary education institution in South Africa were created. Furthermore, the research identified a preferred future for the tertiary education institution.
- Practical value: the scenarios created will offer various stakeholders in the tertiary education sector different insights and analysis into a number of interpretations of the potential paths that they can follow. The scenario application culminated in the formulation and creation of a "future vision of the tertiary education institution in South Africa towards 2030", delivering a platform for skills transformation that will deliver adaptable workers and sustainable and inclusive progress for all South Africans.

5.10 STRENGTHS AND WEAKNESSES OF THE RESEARCH

By studying the future of education, the researcher understood that the future determines the present, and that the body of knowledge generated will contribute to the future we see. After all, the image of tomorrow is cast from the choices we make today. Thus, in mapping the past and present, a comprehensive environmental scan was done. It included an in-depth literature review to unearth current forces, drivers and trends that influence the future of the tertiary education institution. The environmental scan and review were utilised to indicate the present state of affairs in tertiary education and its likely trajectory. Additionally, the environmental scan was enriched by the views and assessments of various educational experts.

This research was motivated by the need to shine a light on the 21st century learner, rapidly obsoleting skills, no-collar worker, skills of the future, learning futures, and possibly predict what new jobs may come into existence so that educationists can better prepare for the future. All these factors point to complexity and volatility, and make the case for research into Futures Studies concerning tertiary education. However, despite following a positive future perspective, a win-win scenario for all stakeholders is more difficult to formulate feasibly. Although. if successful, it will be one of the most revolutionary and influential paradigm shifters in South Africa. It would require bureaucrats and policymakers to have a growth mind-set, because the fear from educators and leaders of institutions that new digital technologies will make them irrelevant is palpable. Asking them to embrace disruptive technologies and convincing decision-makers that their lives can be easier will not be easy.

This research only looked at the role of tertiary education in terms of skills transformation, but the issue of skills mismatch is a very complex matter, more so in South Africa. Apartheid legacy, complex labour relations, accessibility, innovation and global mobility all affect skills development. Additionally, there is a dearth of detailed academic studies about the impact of the FIR and disruptive technologies on education, skills and work of the future. The simplistic win-win solution given above may be ignoring the complexity and hyper-connectedness of different drivers and different stakeholders' roles in tertiary education.

5.11 OPPORTUNITIES FOR FUTURE RESEARCH

The fear that AI and robotics will eliminate jobs and increase inequality is precisely why this research is imperative. The future vision espoused not only provide strategies for future-proofing jobs, but also offers transformative learning that includes reflection and skills. The South African National Development Plan (2030) focuses on job creation and sustainable livelihoods, infrastructure development, improving education, innovation and training, among other things. The infrastructure, political atmosphere, skilled labour and clean institutions required to accommodate the resounding impact of a future-ready education point to a mammoth task ahead. Top of the list will be to incorporate disruptive technologies into the curriculum effectively, and to provide the right conditions to leapfrog from Education 2.0 to Education 4.0. This study aimed to take small steps towards change in South Africa's technological mind-set. It is hoped that the results of the research will engender an understanding of the complications that will arise should technology not be elevated to the levels that are necessary for the fulfilment of the "future vision of the tertiary education institution in South Africa towards 2030".

"Future vision of the tertiary education institution in South Africa towards 2030", based on and developed in the "Stairway to Heaven" scenario, offers some possible practical recommendations which recognise and propose actions needed by the collective stakeholders of tertiary education in South Africa. It is critical that these stakeholders are front and centre in planning, monitoring and evaluating the implementation of the "future vision of the tertiary education institution in South Africa towards 2030", in order to guarantee that the envisioned outcomes are provided along the path to a preferred future. A practical framework will be required for co-creation by different stakeholders, thereby integrating the results and the successes of programme and policy interventions for enhancing access to the highest quality of education and training for all. Future research needs to probe policy integration, since skills initiatives are often a product of adding new policy instruments and goals to an existing policy mix. Furthermore, it is apt that the research focuses on how labour relations, local politics and *ubuntu* values might affect the four tertiary education institution futures towards 2030.

5.12 CONCLUSIONS AND RECOMMENDATIONS FOR THE FUTURE OF THE TERTIARY EDUCATION INSTITUTION IN SOUTH AFRICA

The four scenarios for the tertiary education institution of the future in this research study show how the role of tertiary education's skills development can unfold and change in South Africa towards 2030. These scenarios can be used as departure points by tertiary education providers to make strides towards the Global Sustainable Development Education 2030 targets and the attainment of South Africa's Vision 2030 targets contained in the National Development Plan. Equally important is the fact that these scenarios make known what was previously unknown, exploring the possible and impossible, and encouraging new, innovative thinking for decision-makers.

Adopting skills-orientated education in developing a preferred future for South Africa necessitates the development of fresh insight and knowledge regarding the education and training industry and its range of futures. To achieve skills transformation, commitment and dedication is required from all stakeholders wanting to see a solution to skills mismatch. The commitment should lead to a mind shift and a growth mind-set, coupled with carefully laid strategies and action plans that can see the "future vision of the tertiary education institution in South Africa towards 2030" realised. Aggressively co-creating course content with industry and relevant stakeholders is the solution, resulting in collaboration on research, projects and offering work-integrated learning. A stance in favour of co-creation increases the probability of realising the "future vision of the tertiary education institution in South Africa towards 2030".

The "future vision of the tertiary education institution in South Africa towards 2030" encapsulates the objectives and NDP 2030 ambitions of all South Africans. Education for alternative futures means an education that not only not discovers tomorrow's problems, but also tries to eliminate them today. In the process, it will future-proof South African people, equipping them to succeed in the digital and knowledge economy. The challenge is even greater for South Africa, because the economy – if highly service-oriented, with a big informal sector and a quality postgraduate education – is supported by a dismal basic education system. Thus, the system requires a double transformation to ensure student-centredness and meet the needs of a future worker. It will achieve this by removing barriers to participation by disadvantaged people groups in lifelong learning and employability programmes. A collective vision, future-

ready leadership and a desire for innovation will ensure that there is acceptance and implementation of a future-ready education to drive skills transformation towards 2030 and beyond.

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ETHICS CLEARANCE

NELSON MANDELA UNIVERSITY

FORM E

ETHICS CLEARANCE FOR TREATISES/DISSERTATIONS/THESES

Please type or complete in black ink

FACULTY: Business Management

SCHOOL/DEPARTMENT: Business School

I, (Adendorff C) the supervisor for (Chikoti P)

(student number) 214038149

a candidate for the degree of MBA

with a treatise/dissertation/thesis entitled (full title of treatise/dissertation/thesis):

The tertiary education institution of the future towards 2030: scenarios for skills transformation

considered the following ethics criteria *(please tick the appropriate block)*:

	YES	NO
1. Is there any risk of harm, embarrassment of offence, however slight or temporary, to the participant, third parties or to the communities at large?		√
2. Is the study based on a research population defined as 'vulnerable' in terms of age, physical characteristics and/or disease status?		√
2.1 Are subjects/participants/respondents of your study:		
(a) Children under the age of 18?		√
(b) NMMU staff?		√
(c) NMMU students?		√
(d) The elderly/persons over the age of 60?		√
(e) A sample from an institution (e.g. hospital/school)?		√
(f) Handicapped (e.g. mentally or physically)?		√

3. Does the data that will be collected require consent of an institutional authority for this study? (An institutional authority refers to an organisation that is established by government to protect vulnerable people)		√
3.1 Are you intending to access participant data from an existing, stored repository (e.g. school, institutional or university records)?		√
4. Will the participant's privacy, anonymity or confidentiality be compromised?		√
4.1 Are you administering a questionnaire/survey that:		
(a) Collects sensitive/identifiable data from participants?		√
(b) Does not guarantee the anonymity of the participant?		√
(c) Does not guarantee the confidentiality of the participant and the data?		√
(d) Will offer an incentive to respondents to participate, i.e. a lucky draw or any other prize?		√
(e) Will create doubt whether sample control measures are in place?		√
(f) Will be distributed electronically via email (and requesting an email response)? Note: • If your questionnaire **DOES NOT** request respondents' identification, is distributed electronically and you request respondents to return it *manually* (print out and deliver/mail); **AND** respondent anonymity can be guaranteed, your answer will be NO. • If your questionnaire **DOES NOT** request respondents' identification, is *distributed via an email link and works through a web response system (e.g. the university survey system)*; ***AND*** respondent anonymity can be guaranteed, your answer will be NO.		√

*Please note that if **ANY** of the questions above have been answered in the affirmative (YES) the student will need to complete the full ethics clearance form (REC-H application) and submit it with the relevant documentation to the Faculty RECH (Ethics) representative.*

and hereby certify that the student has given his/her research ethical consideration and full ethics approval is not required.

_____ 24/04/18 _____
SUPERVISOR(S) **DATE**

_____ 10 May 2018
HEAD OF DEPARTMENT **DATE**

_____ 24/04/18 _____
STUDENT(S) **DATE**

Student(s) contact details (e.g. telephone number and email address):

0786001429. pchikoti87@gmail.com

Please ensure that the research methodology section from the proposal is attached to this form.

PERMISSION TO SUBMIT A TREATISE FOR EXAMINATION APPROVAL

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'D/116/13 (28-02-2013_17h31)
(formerly D/823/05)

NELSON MANDELA
UNIVERSITY

PERMISSION TO SUBMIT A TREATISE/DISSERTATION/THESIS FOR EXAMINATION

FACULTY: Business & Economic Sciences

SCHOOL/DEPARTMENT: NMU Business School

DEGREE: Master in Business Administration

SURNAME, INITIAL: Chikoti, P

STUDENT NUMBER: 21403849

1. Has this treatise/dissertation/thesis been submitted with your knowledge and support?

YES	NO

(Please tick the appropriate response clearly)

2. Submission Recommendation:

A. Permission Granted for submission for examination	X
B. Permission Granted for submission for examination with reservations	
C. Submission against advice of Supervisor	

(Please tick only the applicable response clearly)

3. Did the candidate's research involve animal experimentation or human subjects as defined in the Nelson Mandela University Policy on Ethics in Research?

YES	NO

(Please tick the appropriate response clearly)

If YES, has clearance been obtained from the relevant Ethics Committee?

YES	NO

(Please tick the appropriate response clearly) If YES, kindly provide ethics clearance reference number)

SUPERVISOR — DATE: 27 NOVEMBER 2018.

CO – SUPERVISOR — DATE

CO – SUPERVISOR — DATE

CO – SUPERVISOR — DATE

CONFIRMATION OF LANGUAGE EDITING

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Candidate: Patrick Chikoti

MBA Dissertation Title:

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SCENARIOS FOR SKILLS TRANSFORMATION

This serves to confirm that I, Sara Thackwray,
have provided a full language editing service to the candidate,
Patrick Chikoti,
in preparation for the submission of the aforementioned dissertation.

Yours faithfully,

Sara Thackwray (Mrs)

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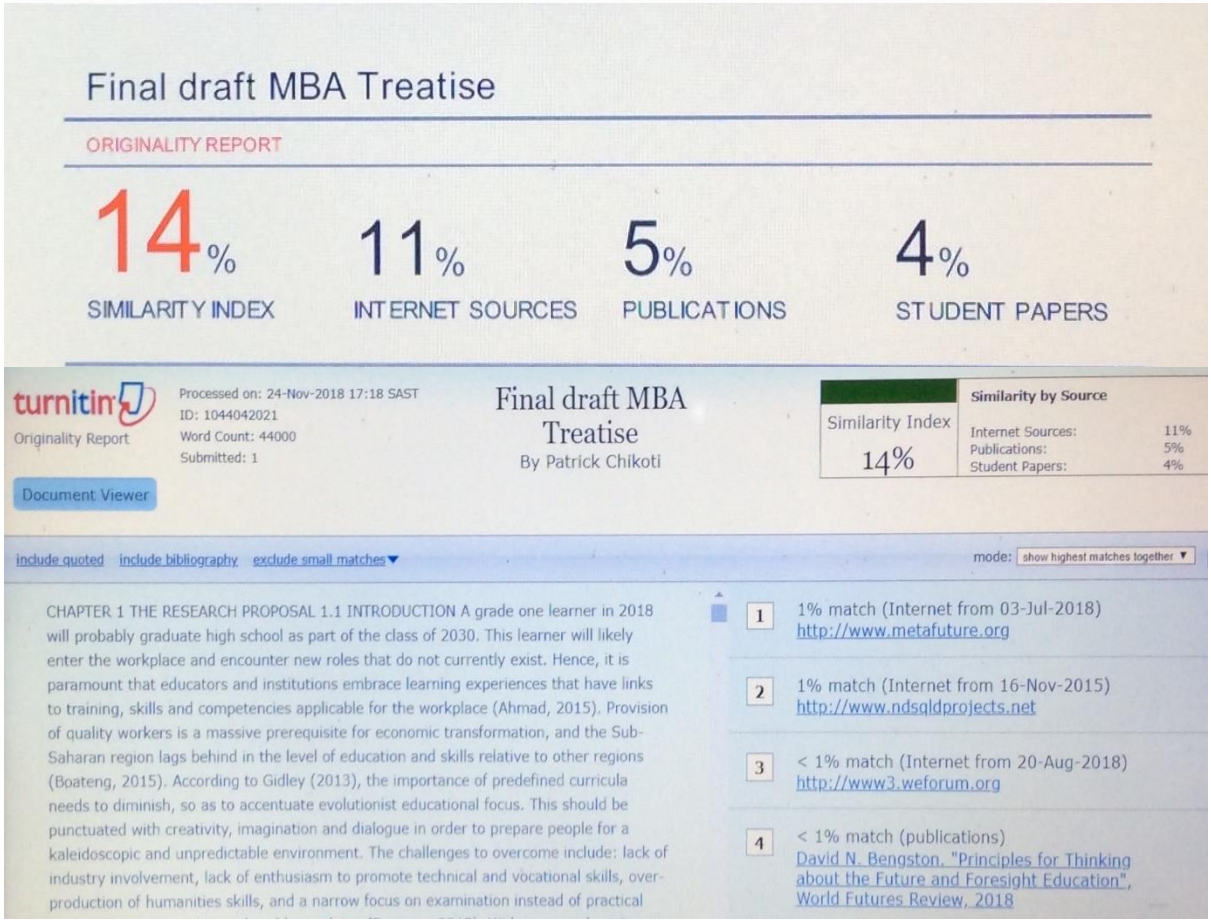

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LIST OF ACRONYMS AND ABBREVIATIONS

3IR	Third Industrial Revolution
AI	Artificial Intelligence
AIEd	Artificial Intelligence in Education
AR	Augmented Reality
CHE	Council for Higher Education
CLA	Causal Layered Analysis
DOL	Department of Labour
DHE	Department of Higher education
DHET	Department of Higher Education and Technology
EIA	Emerging Issues Analysis
ES	Environmental Scan
ESD	Education for Sustainable Development
EY	Ernst & Young
FDI	Foreign Direct Investment
FIR	Fourth Industrial Revolution
GDP	Gross Domestic Product
GRPS	Global Risks Perception Survey
HE	Higher Education
ICT	Information and Communication Technologies
IoE	Internet of Everything
M&C	Mckinsey & Company
MOOC	Massive Open Online Courses
NBIC	Nanotechnology Biomedicine Information Technology and Cognitive Science
NDP	National Development Plan

NGO	Non-Governmental Organisation
NPC	National Planning Commission
NSA	National Skills Authority
NSFAS	National Students Financial Aid Scheme
OECD	Organisation for Economic Co-operation and Development
OA	Oxford Analytica
PESTLE	Political, Economic, Social, Technological, Legal and Ecological
PIRLS	Progress in International Reading Literacy Study
PSET	Post-School Education and Training
PwC	PricewaterhouseCoopers
R&D	Research and Development
RSA	Republic of South Africa
SAQA	South African Qualification Authority
SETA	Sector Education and Training Authority
STEM	Science Technology Engineering Mathematics
TVET	Technical and Vocational Education and Training
UBI	Universal Basic Income
UCT	University of Cape Town
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VR	Virtual Reality
WEF	World Economic Forum
WSJ	Wall Street Journal
WWF	World Wide Fund for Nature