Competitiveness of South African ICT companies

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A thesis submitted to the Faculty of Commerce, Law and Management, The University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Doctor of Philosophy

Supervisor: Dr. Renee Horne

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Compliance Table

This covering letter is in reference to the comment made on the combined examiners report. The details of the corrections made in response to the comments made by the three reviewers are specified in the table below:

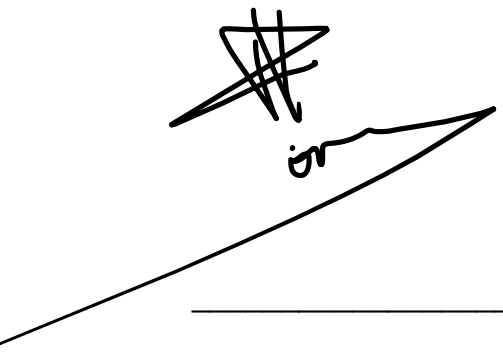
1st Reviewer Comment	**Compliant**
7 – Limited references in chapter 7 references	The chapter has been updated with relevant references
Acknowledgement section, page iii and iv needs to be removed	I have removed the part of that section that contained the names of the participants
Pages 60-70 showing organization name	The names of the organizations have been expunged on the different pages
Table of content and figures	The table of content and figures have been properly updated
Abbreviations	All the abbreviation used have been updated in xii and xiii
Figures used are unclear	All the figures used for the work have been rearranged and corrected to the right font and size
Align research objectives and research questions	The research objectives and research question in chapter one has been aligned properly as seen in page 7
2nd Reviewer Comment	**Compliant**

Corrections of minor typographical errors	The researcher has corrected all the necessary typographical errors as seen in the work.
References	All the references cited in the body of the work have been captured in the end of the work references
3rd Reviewer Comment	**Compliant**
1.1 The main story (see the first paragraph under Purpose of Statement) seems to evolve around the various rankings of SA. Why not tabulate these rankings to aid readability	Correction effected and the competitive ranking tabulated in page 1-2
Background of the study started with ICT in South Africa	The researcher has made a correction by reviewing studies on ICT globally before narrowing it down to ICT in South Africa in page 1-2
1.2 paragraph 7	The researcher has made correction and better and more scholarly literature was capture in place of the previous information in page 2-3
vi. Reason for conducting the study in South Africa	The researcher has added a good reason why he is carrying out the study in South Africa which is that despite the growth in the ICT sector in South Africa, there are still challenges facing the ICT sector in South Africa. One of the main challenges is the digital divide, which refers to the unequal

	distribution of internet connectivity and digital technologies between different regions and socioeconomic groups in page 1-2.
vii. Move table 1.9 to appendix	The researcher has moved the table to the appendix in page 225
2.4 and 2.5	The sections were updated with literatures that provided a clearer review of ICT in Africa and globally in page 41,42,43
2.3 theory discussion	This section has been updated by justifying the relevance of the theories to ICT in South Africa in page 17-18
iii. Insert a section discussing on the role of ICT on economics development	A section has been added to the literature discussing the role of ICT in economics development in South Africa as section 2.5.6 in page 41.
Conclusion in chapter two	Conclusion of the study has been included which highlighted the gaps and the main arguments discussed in page 49.
I. Reference error of Saunders and Thornhill (2009)	Corrected (Saunders, Lewis & Thornhill 2009) in page 50.
ii. Too much time spent defining terminologies	Corrected as some of the areas were expunged in page 57.

3.10. How to minimize the limitation	Steps used in minimizing the limitations were highlighted by the researcher in page 67-68
How did you arrive at the information from table 8-10	The information's were the authors conceptualization
Section 7.3.1 on theoretical contribution	The researcher designed a new theoretical contribution that filled the gap in page 165-166
Methodological contribution	The researcher has added to the methodological contribution in page 167
Correction of references	The references have all been corrected with the full journal information

I hereby certify that to the best of my knowledge all the corrections suggested by the three examiners have been done in my capacity as supervisor.



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15 June 2023

General Note: Posthumous Award and Corrections for Anton Christopher

This thesis, titled "Competitiveness of South African ICT companies," was submitted for examination by the late Anton Christopher in February 2021. Regrettably, Anton Christopher passed away before the completion of the examination process.

In accordance with the regulations and academic standards of the University of the Witwatersrand, a panel of examiners was appointed to evaluate the thesis. However, due to the unfortunate circumstance, the examiners' reports were not finalised prior to Anton Christopher's demise.

To ensure the completion of the examination process, the necessary corrections recommended by the examiners were diligently carried out by Dr. Renee Horne, Anton Christopher's supervisor. Dr. Renee Horne was intimately familiar with Anton Christopher's research and had actively supervised the work from its inception.

It is important to note that the corrections were conducted with utmost care and adherence to the original intent and scholarly contribution of Anton Christopher. The authenticity and integrity of the thesis have been preserved throughout this process. The corrections undertaken by Dr Horne are appended to this note.

Despite his untimely passing, we recognise Anton Christopher's exceptional contributions to the field, which merit the posthumous awarding of the degree. Therefore, with great pleasure, we announce the successful fulfilment of all requirements for the Doctoral degree in Management by Anton Christopher.

Acknowledging these extraordinary circumstances, this note is appended to the thesis, signifying that the degree has been awarded posthumously. This serves as a tribute to Anton Christopher's memory and academic accomplishments.

We extend our deepest condolences for losing a talented researcher and scholar. We also express our gratitude to Dr. Renee Horne for her unwavering dedication in undertaking the necessary corrections.

For any further inquiries or information, please contact the Wits Business School.

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DECLARATION

I, **PIUS ANTON CHRISTOPHER**, do hereby declare that this thesis is my own work and that all the data sources that have been used or quoted have been indicated and acknowledged by means of complete references. This thesis has not been previously submitted before for any degree or examination at this or any other university.

Signature: _____

Date: _____

DEDICATION

I dedicate this thesis to my late parents and aunts who always believed in my capabilities and have been an inspiration to me.

ACKNOWLEDGEMENTS

First, I would like to thank my supervisor, Dr. Renee Horne, for her support and guidance throughout my PhD journey.

I would like to thank the academic staff of the Wits Business School who steered me to resource-based theory.

I wish to thank the PhD Programme Manager, Mmabatho Leeuw, for her support and assistance.

Completion of this thesis would not have been possible without the research participants. I therefore take this opportunity to acknowledge and extend my appreciation to the participants who shared their knowledge and sacrificed their time for this study.

Finally, I would like to extend my deep appreciation to my children, Thabiso Christopher and Dr Lerato Christopher. You encouraged me all the way: I could not have done it without you.

ABSTRACT

A key issue facing the South African economy is the competitiveness of the ICT industry. With the growth of ICT multinationals in South Africa, the competitiveness of the local ICT industry is under scrutiny.

A grounded theory-based qualitative methodology was deployed by interviewing participants drawn from the South African ICT industry and ICT multinationals in the country. Participants have experience of more than 20 years in ICT industry and worked at executive or senior management level. Data was collected through semi-structured interviews until theoretical saturation was reached. Data analysis was carried out using ATLAS.ti software.

The study indicated that the South African ICT industry is only competitive within the South African ICT service sector, while not being globally competitive in the ICT manufacturing and ICT software development sectors. The study also found that ICT multinationals are competitive because of their strategically valuable resources (SVRs). These resources are both internal and external. External strategically valuable resources (SVRs) are their respective government policies and funding. Internal resources include cost-effectiveness, work ethics and innovation. Some of these resources are country-specific, while others are firm-specific. The study also showed that historically, the South African ICT industry was competitive and possessed strategically valuable resources (SVRs). It was also found that the South African ICT industry still possesses some strategically valuable resources (SVRs), these being mainly in the ICT service sector. Finally, the study also determined a framework of strategically valuable resources (SVRs) that can make the South African ICT industry competitive again.

This research makes a significant theoretical contribution by enhancing resource-based theory, doing so by extending the theory – specifically an enhanced resource-based view – to a country and a heterogeneous ICT industry. This research also contributed a theoretical framework to the existing literature on resource-based theory. An empirical contribution is reached by firmly establishing the link between the competitiveness of ICT multinationals and their strategically valuable resources

(SVRs). A methodological contribution is gained by employing grounded theory-based qualitative methodology to research the ICT industry. Finally, the study provides practical recommendations to government policymakers and other stakeholders.

Key words: Resource-based theory, ICT industry, competitiveness, strategically valuable resources (SVRs).

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
BPM	Business Process Management
BPO	Business Process Outsourcing
CAGR	Compound Annual Growth Rate
CPUT	Cape Peninsula University of Technology
ERP	Enterprise Resource Planning
EXIM	Export Import Bank of China
FAA	Federal Aviation Authority
FDI	Foreign Direct Investment
4IR	Fourth Industrial Revolution
ICT	Information Communications Technology
ICT industry	ICT service sector, ICT manufacturing sector and ICT development sector
IoT	Internet of Things
ITes	Information Technology-enabled services
MNC	Multinational Corporation
NIIT	National Institute of Information Technology
NOTAM	Notice to Airmen
OECD	Organization for Economic Cooperation and Development
OFDI	Outward Foreign Direct Investment
PEST	Political, Economic, Socio-cultural, Technological analysis
PTTs	Post, Telegraph and Telecommunication services
RBT	Resource-Based Theory
RBV	Resource-Based View
SETA	State Education and Training Authorities
SVR	Strategically Valuable Resource
SUNSAT	Stellenbosch UNiversity SATellite
TCS	Tata Consulting Services
TQM	Total Quality Management
WOAN	Wholesale Open Access Network

Chapter 1: Introduction

1.1. Purpose Statement

In recent years, the Information and Communication Technology (ICT) industry in South Africa has undergone significant growth; this sector plays a vital role in supporting the growth and development of the country's economy, therefore its rapid expansion is not surprising. (Binuyo and Aregbeshola, 2014). It is essential for South African enterprises to remain competitive both inside their own country and on the global market, and the information and communications technology (ICT) industry is a crucial enabler of innovation, productivity, and competitiveness. (Chisenga, 2006). Despite the expansion and promise of the business, South African information and communications technology companies confront a myriad of obstacles that limit their ability to compete. (Adeniran & Johnston, 2016). These constraints include high levels of rivalry from domestic and international enterprises, an inadequate infrastructure, a shortage of skilled people, and limited access to capital and resources. (Maisiri & van Dyk, 2021). In addition, the digital divide in South Africa is a serious problem. Millions of people in South Africa still do not have access to the internet or other technological services, which restricts the market for information and communications technology (ICT) companies. In the field of digital competitiveness, the World Competitiveness Report 2021 classified South Africa as the 56th most competitive economy out of 64 total countries. The following are some of the considerations that went into creating this ranking:

Group	**Ranking**
Connectivity	South Africa ranked 59th in terms of fixed broadband subscriptions per capita and 61st in terms of mobile broadband subscriptions per capita.

Technology adoption	South Africa ranked 58th in terms of businesses' digital adoption and 50th in terms of individuals' digital skills.
Digital transformation	South Africa ranked 48th in terms of businesses' agility to adopt new technologies and 60th in terms of the government's digitalization strategy.
Regulatory framework	South Africa ranked 52nd in terms of the government's support for digital technologies and innovation

However, some South African ICT companies have been successful in developing innovative products and services, expanding their operations, and competing in international markets. For example, companies such as Dimension Data, MTN Group, and Naspers have grown into global players and have contributed significantly to the growth and development of the ICT industry in South Africa. Therefore, this thesis aims to explore the competitiveness of South African ICT companies in a global market and identify the key drivers of competitiveness for the industry. By analyzing the factors that contribute to the competitiveness of South African ICT companies, this study will provide insights into strategies and policies that can be used to support their growth and development. The study will also determine the strategically valuable resources (SVRs) required by South African ICT companies to develop the global competitiveness of the South African ICT industry.

1.2. Context

The South African information and communication technology (ICT) industry has undergone significant growth over the past few years and has become a crucial driver of the country's economy (Maisiri & van Dyk, 2021). However, in today's global market, South African ICT companies face intense competition from other emerging and established economies. The question that arises is whether the South African ICT industry is competitive enough to sustain its growth and success in the global market.

One of the key factors that affect the competitiveness of South African ICT companies is the availability of a skilled workforce (Adeniran & Johnston, 2016). According to Czerniewicz (2019), companies require a workforce with both technical and soft skills to succeed in a competitive market. Although South Africa has a relatively high number of graduates in ICT, there is a significant skills mismatch in the industry, with most graduates lacking practical experience in the latest technologies. This mismatch makes it challenging for South African ICT companies to compete globally, where a skilled workforce is essential (Gillwald, Moyo, & Stork, 2015).

Innovation is another critical factor that affects the competitiveness of South African ICT companies. In today's fast-changing market, companies must continually innovate to stay ahead of the competition. Hlongwane (2020) notes that innovation is essential for companies to create new products and services that can meet the changing needs of the market. However, South African ICT companies face several challenges in their innovation efforts, including limited access to funding, low levels of R&D, and a lack of collaboration between industry and academia (Zulu, Pretorius & van der Lingen, 2021). Infrastructure is another critical factor that affects the competitiveness of South African ICT companies. A reliable and efficient infrastructure is essential for companies to operate efficiently and deliver their products and services to the market (Salahuddin & Gow, 2016). However, South Africa's infrastructure is inadequate and requires significant investment from both the government and the private sector to improve. For instance, the country's broadband penetration rate is still low, making it difficult for companies to access the latest technologies and compete effectively in the global market.

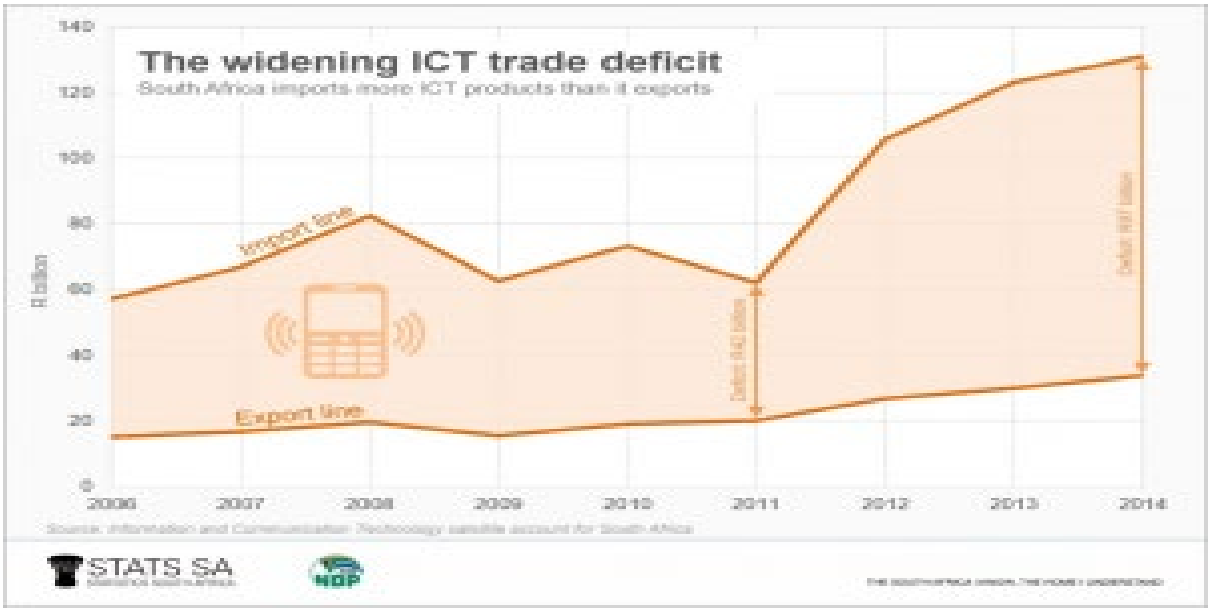
Moreover, government policies also play a crucial role in promoting the competitiveness of South African ICT companies (Salahuddin & Gow, 2016). The government needs to develop policies that support the growth of the ICT industry, such as tax incentives, subsidies for R&D, and investment in infrastructure. However, the government's efforts have been limited, and policies have not been implemented effectively, affecting the industry's overall competitiveness. In conclusion, the South African ICT industry has made significant progress in recent years, but there is still a long way to go to compete effectively in the global market. The industry's

competitiveness is affected by several factors, including the availability of a skilled workforce, innovation, infrastructure, and government policies. Addressing these challenges and developing effective strategies can help the South African ICT industry to remain competitive in the global market and sustain its growth and success.

1.3. Research Problem

An examination of the relevant literature indicates that South Africa is lagging behind developed and emerging countries in digital competitiveness (IMD, 2021). It also shows that South Africa is changing from being an ICT producer to an ICT end-user, that ICT operations are moving offshore, and that ICT imports far exceed ICT exports (Stats SA, 2017). Figure 1 below shows how the gap between ICT imports and ICT exports has been expanding over the years.

Figure 1: Widening ICT trade deficit



Source: Stats SA (2017).

In addition, the relevant literature shows that ICT exports are no longer competitively sustainable, as a result of competition from MNCs. South Africa's largest ICT exports are primarily telecommunications and broadcasting services to the rest of Africa. These exports are under threat from other MNC operators such as Bharti Airtel and video streaming services such as Netflix (McLeod, 2020). Bharti Airtel is the third

largest single-country operator and sixth-largest integrated telecommunications operator in the world (Reddy, Nangia, & Agrawal, 2012).

South Africa's major telecommunications operator MTN faced a quagmire of regulatory and financial issues in Nigeria, which is MTN's largest operation on the continent (TechCentral, 2018), and in Uganda. In addition, high-tech exporters such as Denel are suffering losses of highly skilled staff (defenceWeb, 2020).

The literature points to a link between growing ICT development and economic growth in a country (Avgerou, 2003). Successful economies have more technologies and are better prepared for using them to their global competitive advantage. ICT development is a critical necessity for the 4IR (Monostori, 2014) and is a key element for the overall development and economic expansion of a country (Bankole, 2017; Yildiz, 2016).

Reports also show that emerging technologies have been, and are currently being, developed in countries and regions such as China, India, the US and Western countries, and implemented within South Africa. The 5G infrastructure, or parts thereof, for Rain, Vodacom and MTN is provided by Huawei (Admire, 2020; Huawei, 2020). This 5G infrastructure includes Artificial Intelligence (AI) and Machine Learning. An analysis of top blockchain developer firms in South Africa shows they are mostly either multinationals or the development is done offshore (TheManifest, 2021a). The same applies to AI (TheManifest, 2021b), as well as to big-data analytics (GoodFirms, 2021). Survey drones available in the country are manufactured abroad. FinTech services to eight of the ten top banks are provided by Tata Consultancy Services or other Indian companies (TCS, 2017).

For the reasons cited above, South Africa's current ICT industry will be dependent on external ICT resources and workforces for the 4IR. Consideration of the literature also shows that countries failing to leverage the emerging 4IR technologies will fall behind those countries that do (Monahan, 2017; Schwab, 2017).

It is clear, then, that there is a need to develop the global competitiveness of South Africa's ICT industry. The problem facing the South African ICT industry is how to develop its global competitiveness. There is limited existing literature on the

competitiveness of the South African ICT industry and how to develop its global competitiveness, or how to develop the ICT industry in other countries.

The ICT industry is heterogeneous and existing literature shows that the enhanced resource-based view is the most suitable theory with which to study the competitiveness of a heterogeneous industry. The core of the enhanced resource-based view is the application of strategically valuable resources (SVRs) within a company or industry, to develop competitive advantage. However, the literature also shows that the enhanced resource-based view is still in its formative years and is yet to be applied to a major, diverse industry such as an ICT industry.

Given this background, a study is needed to determine the strategically valuable resources (SVRs) required to develop the global competitiveness of the South African ICT industry. These are the resources that would provide the foundation to develop firm capabilities, leading to superior performance over time, and provide a competitive advantage over competitors (Edwards, 2014).

The theoretical benefit of the study is the development of enhanced resource-based theory by developing it to cover a diverse industry such as the ICT industry. The practical benefit of the study is that a globally competitive local ICT industry will be able to reduce dependency on ICT multinationals from emerging economies and developed economies and address the ICT trade balance while sustaining South Africa's economic growth.

1.4. Research Objectives

There is a need to develop the competitiveness of South Africa's ICT industry as it plays a significant role in the growth of the economy (Avgerou, 2003). In addition, it is the foundational building block for the emerging technologies in the 4IR (Monostori, 2014). The relevant literature shows South Africa is lagging behind other developed and emerging countries in ICT competitiveness (World Bank, 2019).

The objectives of this research are as follows:

a) To examine and analyze the competitiveness of the South African ICT industry compared to ICT multinationals operating in South Africa; and
b) To determine the strategically valuable resources (SVRs) required to develop the competitiveness of the South African ICT industry.

1.5. Research Questions

The study aims to answer the following research questions:

- What is the current competitive status of the South African ICT industry as compared to ICT multinationals operating in South Africa?
- What are the current strategically valuable resources (SVRs) of the ICT multinationals that are competing with the South African ICT industry?

1.6. Significance of the study

This study is expected to make theoretical, methodological, empirical and practical contributions to the current academic body of knowledge (Bergh, 2003a; Corley & Gioia, 2011; Whetten, 1989).

This study makes the following theoretical contribution.

The review of the literature indicates the following gaps: firstly, few studies have addressed the global competitiveness of the South African ICT industry; and secondly, there is limited literature on the application of resource-based theory or enhanced resource-based theory to the global competitiveness of an industry, including the ICT industry. There is literature covering the application of the resource-based view (RBV) to business/ICT alignment in European organisations (Cumps, Viaene, Dedene, & Vandenbulcke, 2006; Maes, Rijsenbrij, Truijens, & Goedvolk, 2000). There is also literature on the application of the RBV to the role ICT plays in the competitiveness of a firm (Mata, Fuerst, & Barney, 1995; Ong & Ismail, 2008). However, this literature looks at ICT as a business function and not as an industry. Another gap is the limited

research available on the competitiveness of MNCs over their local counterparts in the ICT industry. There is also limited literature on the impact of external factors such as multinationals and government interventions on the application of resource-based theory or enhanced resource-based theory to an industry, including the ICT industry. Finally, there is limited contemporary literature available on the strategically valuable resources (SVRs) required to develop the global competitiveness of the ICT industry, including South Africa's ICT industry. Current theories of positioning thought, such as Porter's Five Forces model, have limited application to competitiveness in the ICT industry, which is heterogeneous and evolving rapidly. Unlike the positioning-based school of thought, the resource-based school considers firms to be heterogeneous and as such they should have their own strategically valuable resources (SVRs) that provide them with sustainable competitive advantage (Hall, 1993; Oliver, 1997). The enhanced resource-based view considers external factors as strategically valuable resources (SVRs) in addition to internal resources. As such, the gaps identified warrant the need to study South African ICT competitiveness using the enhanced resource-based view as the foundation theory and then determine the strategically valuable resources (SVRs) required to develop the global competitiveness of South Africa's ICT industry. ICT is one of the largest and most diverse industries in the country. Taking the above into account, this study will make a significant theoretical contribution to enhanced resource-based review.

The study makes the following contribution to research methodology.

Firstly, it will be based on data collected through semi-structured interviews, demonstrating how studies of competitiveness can be built from semi-structured interviews. Secondly, the issue of trustworthiness is applied to the qualitative research instead of reliability and validity. Thirdly, directed content analysis is used to analyse the data. Directed content analysis is utilised here as there is already an existing theory (Hsieh & Shannon, 2005) and it offers a more structured approach. Finally, in line with grounded theory methodology, the researcher starts by identifying key concepts or variables as initial coding categories (Hsieh & Shannon, 2005). In this study, some of the SVRs of the MNCs are identified from the existing literature through thematic analysis. Questions from the interview protocol are first put to a selected initial

participant. Selection of an initial participant is a contribution to the methodology. The intial participant has had long experience with the South African ICT industry and with ICT multinationals operating in South Africa. Subsequently other participants are interviewed using targeted questions based on predetermined coding categories. Additional codes are further developed. The entire process is iterative in accordance with grounded theory strategy to achieve theoretical saturation. Knowledge of the research subject and knowledge of the organisations whose members are being interviewed enhanced the trustworthiness and interpretation of the data.

A researcher should be aware of any possible subjective bias and of any possible pre-conceived opinions, in order to use the ATLAS.ti software objectively for data analysis (Smit, 2002). Furthermore, by providing a presentation on the enhanced resource-based view and emerging technologies to participants before the interview, the researcher is adding value to the research method.

The study makes the following empirical contribution.

Firstly, the research will establish a relationship between the competitiveness of an ICT company or industry and the strategically valuable resources (SVRs) in the company or industry. Secondly, by focusing on competitiveness in the South African ICT industry, this study will contribute to the empirical knowledge of ways in which the global competitiveness of an industry, or a company, can be developed. Thirdly, the experiences of participants from the ICT industry will provide detailed valuable empirical data in the form of thick description (Ponterotto, 2006). This empirical data in the form of thick description, obtained from interviews, will provide substantial knowledge to other stakeholders – both government and private sector – in South Africa's ICT industry. Fourthly, the results of this study can assist the ICT industry in South Africa by providing a framework of strategically valuable resources (SVRs) to develop the global competitiveness of ICT firms, thereby addressing the research problem. Finally, previous studies on South African ICT were carried out during the period that US and European multinationals were dominant in the ICT field. In the last decade, Indian and Chinese multinationals have become dominant ICT players in the global arena as well as significant players in the South African context. This study will thus provide an empirical contribution to the academic body of knowledge of the South

African ICT industry, multinationals in the South African ICT industry, and current developments in ICT. It will also offer business value by providing the knowledge so gained to business leaders in the country.

1.7. Scope of the study

During any research study, researchers come across interesting information that is outside the boundaries of the problem under investigation and tend to apply such information to the research. This in turn leads to changes in the scope of the study. For this reason the scope of a study should be clearly defined to avoid changes to the boundaries of the problem (Leedy & Ormrod, 2005).

The current study is designed to examine and analyse the global competitiveness of the South African ICT industry. The intent is therefore to exclusively address the competitiveness of South Africa's ICT industry. Interviews will be carried out with participants from the South African ICT industry, who are executives with more than 20 years of experience in the field. This research does not necessarily represent the views of organisations in the South African ICT industry.

1.8. Limitations of the study

Limitations to this study are as follows. Firstly, the study is limited to the determination of strategically valuable resources (SVRs) necessary to develop the global competitiveness of South Africa's ICT industry. Secondly, the study is limited to a resource-based viewpoint.

1.9. Assumptions

As the data is collected from the strategic decision makers of MNCs involved in the South African ICT industry, it is assumed that they are adequately knowledgeable about the industry both in South Africa and globally and are willing to provide answers in an objective, honest and accurate manner.

A similar assumption is made regarding the strategic decision makers interviewed from the South African ICT industry.

1.10. Conclusion

In this chapter, the status of South Africa's ICT is discussed. The purpose statement, problem statement and research objectives further provide a rationale to develop the competitiveness of the South African ICT industry. The next chapter provides a review of the relevant literature on the enhanced resource-based view as a theoretical framework, and the application of the enhanced resource-based view to the competitiveness of ICT multinationals operating in South Africa. The "golden thread" for this research is: "What are the strategically valuable resources (SVRs) to develop the global competitiveness of the South African ICT industry?"

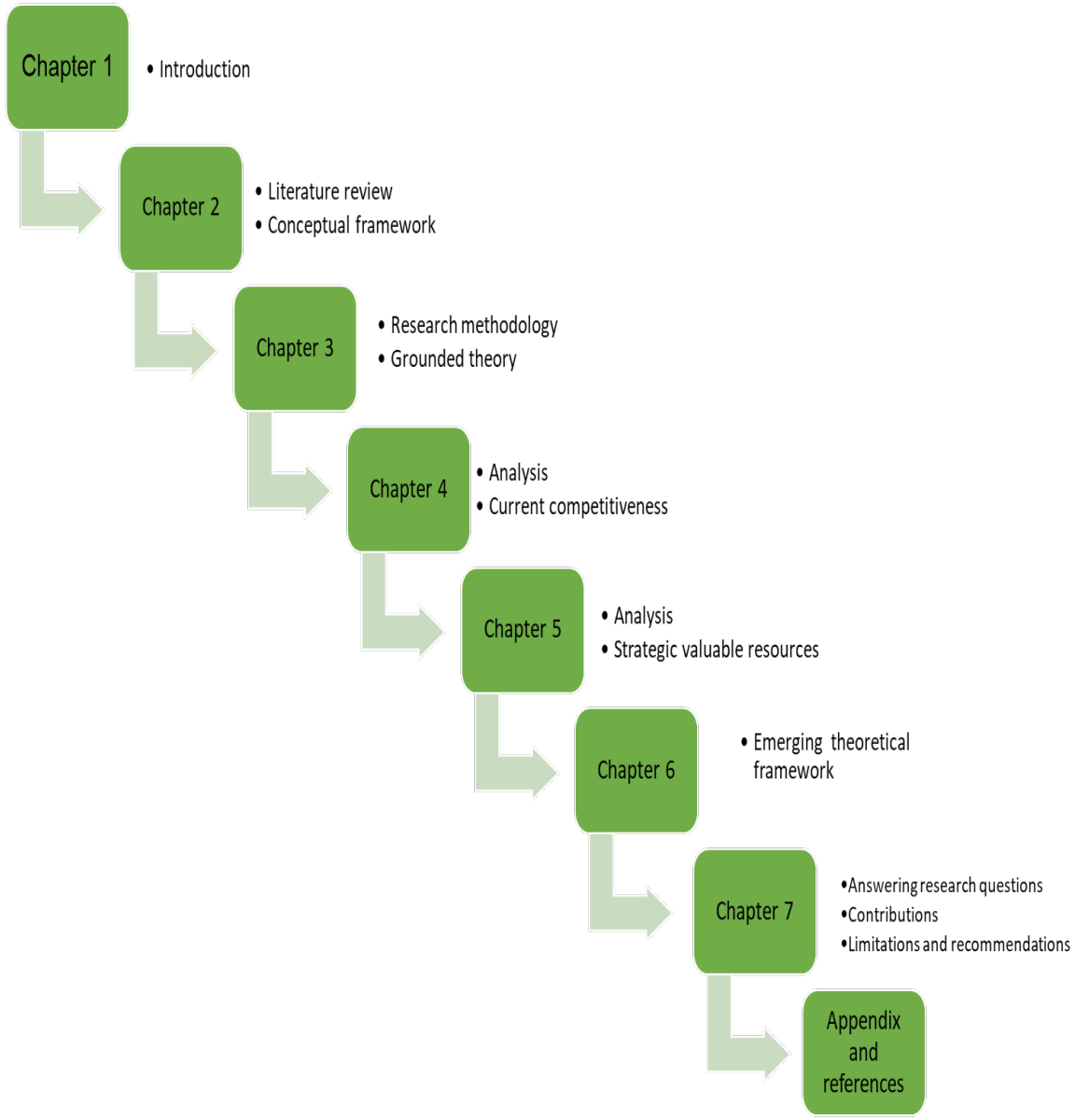
1.11. Outline of the thesis

This thesis contains seven chapters. Chapter 1 presents the introduction and background information relating to the study, together with the problem statement, the purpose of the research and research questions. It also states the delimitation and limitations, as well as the significance of the study. Chapter 2 provides a review of the existing literature on, and conceptual frameworks of, the study. Chapter 3 depicts the methodology used in this study as well as the way data is organised, categorised and analysed. Chapter 4 provides the analysis of data together with discussions on the competitiveness of South Africa's ICT industry. Chapter 5 offers further analysis and discussion covering strategically valuable resources (SVRs). Chapter 6 presents discussions leading to the theoretical framework. Chapter 7 arrives at answers to the research questions posed here in Chapter 1, after which contributions to current knowledge are presented, together with recommendations for future research. The final section of this thesis contains appendices and a list of references consulted in the course of the study.

Figure 3 below visually outlines the structure of this thesis.

Figure 2: Structure of the thesis

Source: Author's construction



Chapter 2: Literature Review

2.1. Introduction

Globalisation has led to the spread of businesses around the world (Ocloo, Akaba, & Worwui-Brown, 2014). According to Craig and Douglas (2005) every company – big or small – faces the impact of globalisation in the form of global competition. Businesses are no longer competing merely within national boundaries. They are competing against multinationals.

This literature review is carried out with reference to the research problem: “How to develop the global competitiveness of the South African ICT industry”, and the primary research question: “To determine strategically valuable resources (SVRs) to develop the global competitiveness of South African ICT industry”.

A literature review explores what is known about a study (Hart, 2001; Kreuger & Neuman, 2006). Through the literature review, the researcher focuses on the research problem and determines gaps in the literature, together with convergent and divergent views (Mouton, 1996).

The first part of this chapter reviews relevant literature dealing with competitiveness and theories of competitiveness, in a resource-based view based on the research problem. The second part of the chapter includes a synopsis of the application of the resource-based view to the global competitiveness of the ICT industry in the major ICT powers, these being the US, China, India and the European Union. The last section of this chapter covers the gap analysis and conceptual framework based on the research questions.

2.2. Competitiveness: a critical view

The concept of competitiveness can be related to a product, firm or industry, or to a sector, region, nation or commercial block, or to a global aspect, and there is a close connection or relationship between all these aspects of competitiveness (Anca, 2012;

Camagni, 2002; Kitson, Martin, & Tyler, 2004). Firstly, according to Anca (2012), the quality of a certain product or service determines the possibilities that a firm will survive the competition. On the other hand, a company's economic performance is connected to the performance of a certain industry, region or even nation on an international scale. Competitiveness is a concept that can be used in a comparative sense or for analysis. As a result of globalisation and the liberalization process, the boundaries between domestic and international markets have become blurred, leading to the disappearance of the distinction between national and international competitiveness (Anca, 2012). Camagni (2002) expresses a similar view, contending that in a globalized economy, territories and firms increasingly find themselves in competition with each other. According to Fagerberg (1996) competitiveness is a not a concept invented by theoreticians, but by policymakers. It is applied at various levels, and in various economies, sectors and firms. It is also a relative term. The World Economic Forum defines the competitiveness of a country as the set of institutions, policies and factors that determine its level of productivity (Klaus, 2019).

However Krugman (1994) argues that competitiveness is a dangerous obsession. Firstly, concerns about competitiveness are, as an empirical matter, almost completely unfounded. Secondly, defining an economic problem as one of international competition is highly attractive to the wider audience. Finally, the obsession with competitiveness is not only wrong but also dangerous, as it skews domestic policies and threatens the international economic system (Krugman, 1996). However Camagni (2002) contends that under-emphasising the importance of competitiveness cannot be accepted in territorial, regional or urban contexts.

International competitiveness is an important topic for policymakers, managers and academics. Policymakers consider competitiveness to be critical to the success of a nation and therefore a central objective of national policies for economic growth. Managers use the competitiveness framework to examine the business environment in order to develop and sustain their own firms' levels of competitiveness (Chen, 2017). Another reason to call for revision of the theories and determinants of competitiveness involves the emerging technologies (e.g. artificial intelligence, robotics) and the emergence of new business models (e.g. the Internet of Things) that significantly

change business models and therefore our understanding of competitiveness (Chen, 2017).

Competitiveness can be at national, industry and firm levels (Ajitabh & Momaya, 2003). A review of the literature relating to competitiveness at these three levels clearly indicated the importance of firm-level competitiveness (Ajitabh & Momaya, 2003)). According to D'Cruz (1992) firm-level competitiveness is defined as the ability of a firm to design, produce and/or market products superior to those offered by competitors, considering both the price and non-price qualities. On the other hand Camagni (2002) contends that in a globalising economy, territories and not just firms increasingly find themselves in competition with each other. In fact, differing countries, cities and regions compete in single-currency areas, based on an absolute advantage principle and not a comparative advantage principle. However Kitson et al. (2004) dispute territorial competitiveness as being an elusive concept, with flawed indicators and over-prescribed policies.

Information and communications technologies (ICT) are defined as a diverse set of technological tools and resources used to communicate and to create, disseminate, store and manage information (Blurton, 1999). As such ICT is heterogeneous. Global competitiveness in ICT takes place at the firm level. This study considers competitiveness primarily at the firm level and then across the ICT industry on the national level.

2.3. Theories of competitiveness

There are many competing theories of competitiveness (Barney, 2001). The Ansoff Matrix (see Figure 4 below) is one of the oldest theories dealing with competitiveness. In 1957 Igor Ansoff proposed four strategies for market growth, concluding that a business firm must continuously grow and change (Ansoff, 1957). The growth vectors are market penetration, market development, product development and diversification (Taylor, 2012).

Figure 3: Ansoff Matrix

	Existing customers	New Customers
Existing products	Market penetration	Market development
New products	New product development	Diversification

Source :(Ansoff, 1957)

Galbraith and Kazanjian (1986b) contend that the character of competition among multinationals changed in the 1980s as a result of globalization. As such, organizational design is critical for a company's performance. Hansen and Wernerfelt (1989) offer two paradigms to explain competition. One paradigm primarily emphasizes the importance of external market factors in determining a firm's competitiveness. Their other line of research builds on the behavioural and sociological paradigm and sees organizational factors and their fit with the environment as major determinants of competitiveness. However, Hansen and Wernerfelt (1989) conclude that first, industry selection and positioning within an industry are important contributors to performance. Secondly, good administrative practices are even more important and thirdly, the economic and organizational effects are independent (Hansen & Wernerfelt, 1989). Fiegenbaum, Hart, and Schendel (1996) include the time factor as an additional dimension for sustained competitive edge.

Enactment theory suggests that companies can create or modify their own environments. Environmental determinism is another theory in opposition to enactment theory. Organisations that do not adapt to the environment fail and fade away. In the history of IT, companies such as Wang and NPR failed to adapt to the introduction of personal computers. Institutional theory considers the extent to which a firm imitates another firm's strategy. Examples are frequent flyer programmes. Transaction cost economics is another theory where the decision to make or buy plays a critical strategic role.

Another theory is Porter’s Five Forces. According to Porter (2008) the five forces governing industry competition are the threat of new entrants, bargaining power of suppliers, threats of substitute products or services, bargaining power of buyers and rivalry among existing competitors. The strongest competitive force or forces determine profitability. Porter (1979) lists characteristics or factors that strengthen each of these five forces. Porter’s model assumes that firms within an industry are homogenous. Even before Porter’s model, Hannan and Freeman (1977) contended there was a relationship between environment and organisational structure.

The idea of Porter's Five Forces is extremely applicable to the context of the information and communications technology (ICT) business in South Africa. This is because the industry is both dynamic and highly competitive, with several firms competing for market share (Grundy, 2006). Since there are many different providers of hardware, software, and services in the South African information and communications technology business, the negotiating strength of suppliers is relatively low (Viviers, Saayman & Muller, 2005). On the other hand, purchasers have a strong bargaining position because customers have a wide variety of options to choose from and can quickly switch between providers. As a result of this, there is a lot of competition in terms of price, and a lot of emphasis is placed on offering high-quality services in order to keep clients (Bruijl & Gerard, 2018).

As a result of the relatively low barriers to entry, the danger posed by new competitors to the South African information and communications technology industry is rather minor (Rose-Tite, 2006). However, given the current level of competition in the industry, new businesses may have a difficult time gaining a significant portion of the market share held by established competitors. Since clients have access to a wide variety of competing products and services, the information and communications technology (ICT) sector in South Africa is facing a significant challenge from competitors (Viviers, Saayman & Muller, 2005). Customers may, for instance, decide to avoid the cost of paying for proprietary software or on-premise solutions by opting to use cloud-based services or software that is free of charge.

Since there are so many competitors in the South African information and communications technology business, the level of competitive tension in this sector is

exceptionally high. Nevertheless, the industry is also defined by collaboration and partnerships, as organizations seek to utilize each other's capabilities and build creative solutions to address the issues faced by customers (Viviers, Saayman & Muller, 2005).

In conclusion, the Porter's Five Forces theory is extremely applicable to the information and communications technology industry in South Africa. Companies are able to find chances for differentiation and build strategies that help them acquire a competitive edge when they conduct an analysis of the competitive forces that exist within their sector. Additionally, South African information and communications technology companies are able to harness their strengths and develop creative solutions to satisfy the requirements of their clients if they work together with other industry participants.

Figure 4: Competitiveness theoretical perspectives

Theoretical perspective	Reference point emphasized	Fundamental prescription	Citations
Motivation theory	Internal organization • Individuals • Groups	Design work and set goals for performance	Latham and Yukl (1975) Nadler and Lawler (1977) Hackman and Oldham (1980)
Resource-based view	Internal organization • Firm-wide resources • Capabilities	Build unique competencies	Wernerfelt (1984) Prahalad and Hamel (1990) Barney (1991)
Industrial economics	External conditions • Industry • Key competitors	Beat the competition	Bain (1956) Caves (1977) Porter (1980)
Resource dependence	External conditions • Suppliers • Customers	Minimize constraints on resources	Pfeffer (1972) Pfeffer and Nowak (1976) Pfeffer and Salancik (1978)
Institutional theory	External conditions • Stakeholders • Interdependencies	Meet demands of society	Meyer and Rowan (1977) DiMaggio and Powell (1983) Meyer, Scott and Deal (1983)
Corporate identity	Time • Past traditions • Philosophy	The past shapes what is possible	Westley and Mintzberg (1989) Torbert (1987) Dutton and Dukerich (1991)
Strategic intent	Time • Long-term purpose • Mission	Strategic intent informs current decisions	Hasegawa (1986) Imai (1986) Hamel and Prahalad (1989)

Source: Fiegenbaum et al. (1996).

In terms of emerging economies Hoskisson, Eden, Lau, and Wright (2000) highlighted three perspectives of strategy. These are institutional theory, transactional cost economics and resource-based perspectives.

There are two important schools of thought relating to the theories of competitiveness. At the firm level, one school of thought builds on the behavioural and sociological paradigm and sees organizational factors and their fit with the environment as the major determinants of competitiveness (Das & Teng, 2000; Hansen & Wernerfelt, 1989). Barney (1991) points out that strategy models based mainly on environmental and industrial scrutiny make a fundamentally flawed assumption that firms within an industry are homogeneous. However, there is a second school of thought based on the importance of external market factors for determining a firm's competitiveness. This suggests that firms need to seek a strategic fit between their internal characteristics (strengths and weaknesses) and their external environment (opportunities and threats) (Das & Teng, 2000). Porter's competitive advantage theories and the Ansoff Matrix model belong to this school of thought.

As ICT is heterogeneous, the second school of thought is more applicable to the competitiveness of ICT firms. The resource-based view belongs to the second school of thought.

2.3.1. Resource-based view

The resource-based view (RBV) has many interpretations. When examining the literature dealing with the resource-based view, the researcher observed that the terms "strategically valuable resources (SVRs)", "strategic assets", "firm resources" and "firm capabilities" are applied interchangeably to produce the same definition.

According to Barney (1991) the RBV examines the link between firm resources and sustainable competitive advantage. Firm resources examined are value, rareness, imitability and sustainability. Three concepts are central to the resource-based view. They are firm resources, competitive advantage and sustained competitive advantage (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). According to Grant (1999) the RBV advocates a relationship between a company's resources and its strategy. As such, company resources play an important role in the company's competitiveness. Even more than 200 years ago in 1817, the British political economist David Ricardo

asserted that relatively few production factors – which may be inelastic in supply – can be the source of profitability for a firm (Ricardo, 2005).

Other researchers have expanded the concept of firm resources. A firm's resources include all assets, capabilities, organisational processes, firm attributes, information and knowledge, etc. that enable the firm to strategize and implement strategies to improve efficiency and effectiveness (Amit & Schoemaker, 1993). These are considered strengths. Firm resources can be further classified as physical capital resources, human capital resources and organizational capital resources.

Instead of firm resources, another set of researchers put forward the concept of strategic assets. Strategic assets are resources and capabilities that will provide competitive advantage to a business. Examples of strategic assets include reputation, buyer-supplier relationships, tacit knowledge, R&D expertise and technological capabilities (Amit & Schoemaker, 1993; Barney, 1991; Mahoney & Pandian, 1992; Rao, 1994). The supply of some of these strategic assets is inelastic (Barney, 2001).

A firm finds itself with a competitive advantage when it is implementing a value-creating strategy that is not simultaneously implemented by any other firm or competitor (Barney, 1991, 2001). A firm experiences sustained competitive advantage when it is implementing a value-creating strategy that is not simultaneously implemented by any other firm or competitor and when competitors are unable to duplicate the benefits of this strategy (Barney, 1991).

Another advantage comes from having strategic resources. Characteristics of strategic resources are that they are rare, valuable, difficult to imitate and non-substitutable. A company's organisational culture could be a strategic resource. Intangible resources have a higher probability of being a strategic resource than a tangible resource. The view that firms are fundamentally heterogeneous, in terms of their resources and internal capabilities, has long been at the core of the field of strategic management (Peteraf, 1993).

When firms interact as competitors, the optimal action depends on how one firm differs from the others. In most cases competition will adversely affect firms that are not

operating at lowest cost/highest quality levels among those making identical efforts (Wernerfelt, 2014). The RBV advocates that every firm should focus on its characteristics and on activities that will bring competitive advantage, while avoiding activities that do not provide competitive advantage. For example, under marketing function, companies traditionally design products based on buyers' needs. However in the RBV, if competitors are better at meeting buyers' needs, then the firm should pursue a different segment of buyers (Wernerfelt, 2014). In the field of operational management, Total Quality Management (TQM) has been applied as the best practice by many firms. However, firms make products with varying levels of quality (Hitt, Carnes, & Xu, 2016). This is because firms' overall capabilities differ, or capabilities may differ across various plants in a firm.

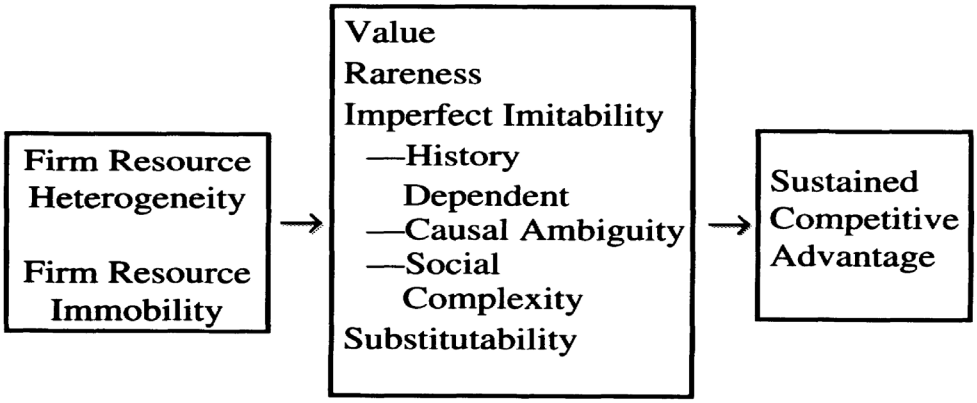
Capabilities are another key concept in the RBV (Grant, 1999). Capabilities are needed to leverage the resources to provide value-added products or services to customers in the field and thereby gain competitive advantages. The RBV of the firm maintains that an organisation's package of resources – which includes tangible and intangible assets, knowledge and skills – is the primary predictor of superior financial performance (Cumps et al., 2006).

Peppard and Ward (2005) contend there are clear distinctions between resources, competences and capabilities. Resources are stocks of available factors that are owned or controlled by the organisation, i.e. information, data, systems, technology, skills and knowledge. Competences refer to an organisation's capacity to deploy resources using processes, practices and structures to produce anticipated ends. For example, IT has become an essential element of firm capability and a contributor to firms' competitive advantage (Abdelkader & Abed, 2016). Finally, a capability refers to the strategic application of competences to accomplish organisational goals.

For a firm, according to Wernerfelt (1984), resources and products are two sides of the same coin. Most products require the services of a number of resources and most resources can be used in a number of products. By specifying the dimensions of the firm's activity in different product markets, it is possible to infer the minimum necessary resource commitments. Conversely, by specifying a resource profile for a firm, it is possible to find the optimal product-market activities.

The diagram below shows the resource-based view according to the leading theorist (Barney, 2001).

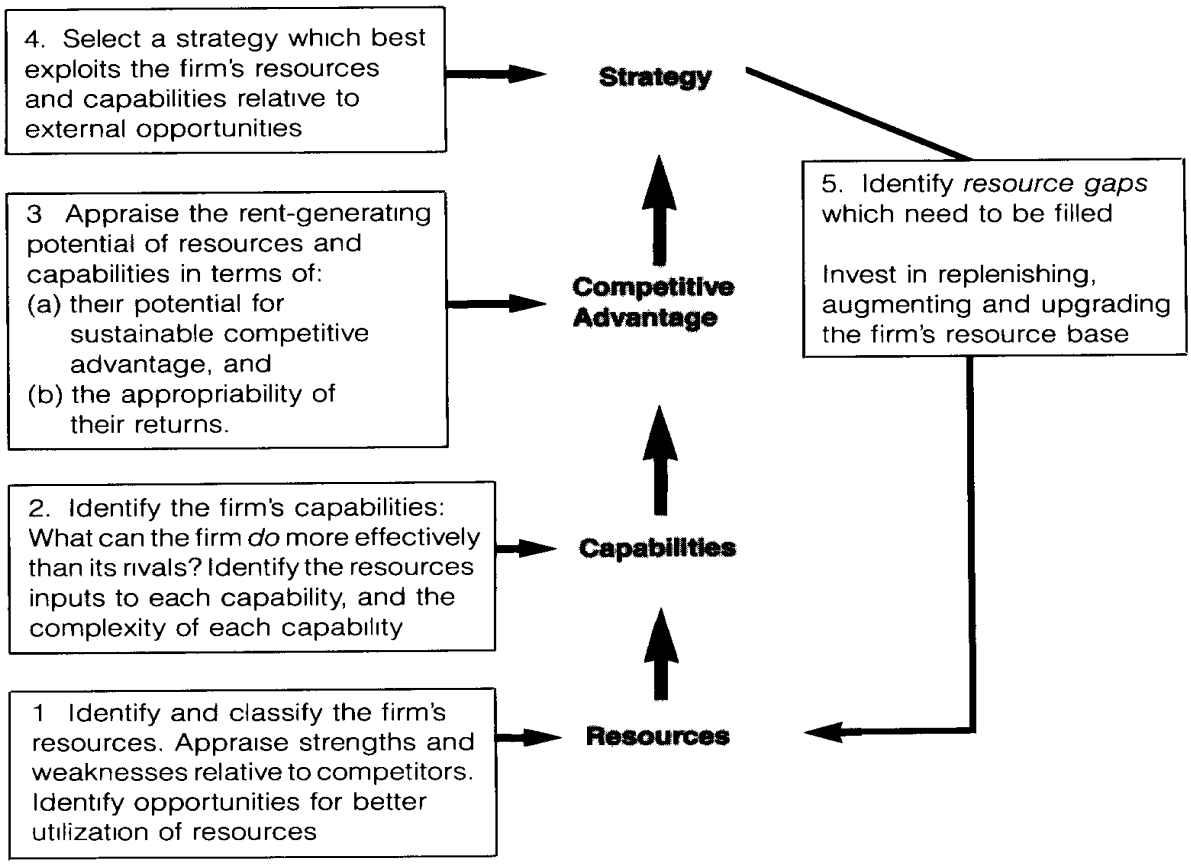
Figure 5: Resource-based view



Source: Barney (1991).

Grant (1999) developed a resource-based approach to strategy analysis as shown in Figure 7 below. In this case a strategy for a firm can be developed starting from resources and moving to capabilities.

Figure 6: Resource-based approach to Strategy Analysis



Source: (Grant, 1999)

Capabilities based on competencies can be classified as functional and cultural (Hall, 1993). Functional capability is related to the ability to do specific things. Cultural capability is applies to the company as whole. Grant (1999) argues that in a world which is in flux, where customer preferences are volatile, and technology is constantly changing, a firm's own resources and capabilities are more stable and provide a more durable basis for strategy. ICT is constantly evolving, and as such, the RBV is the most suitable view to be developed for competitiveness. Conner (1991) believes RBV is close to becoming the "theory" of a firm.

Over a period of time the RBV has become the most influential concept in strategic management research (Peteraf, 1993). Entrepreneurial actions such as the creation and combining of resources to develop new heterogeneous resources can enable RBV by providing alternative uses for resources that have not been previously

considered heterogeneous resources (Alvarez & Busenitz, 2001). A firm’s unique bundle of resources – different to those of competitor firms – is potentially valuable and contributes to a firm’s competitive advantage.

Resource-based view (RBV) is a management theory that argues that a company's resources and capabilities are key determinants of its competitive advantage. The theory suggests that companies should develop and leverage their unique resources and capabilities to create value and gain a competitive edge over their rivals (Lose, 2021). In the context of South Africa's ICT industry, the RBV theory is highly relevant, as the industry is dynamic and highly competitive, with numerous players vying for market share.

One of the unique resources that companies in the South African ICT industry can leverage is their technological expertise. For example, Dimension Data, a South African ICT services provider, has developed expertise in cloud computing, cybersecurity, and digital workplace solutions, which has helped the company differentiate itself from its competitors and win contracts with major clients. Another resource that South African ICT companies can leverage is their knowledge of local market conditions and customer preferences. This can be particularly valuable in a country like South Africa, where there are unique challenges related to infrastructure, digital literacy, and access to technology (Binuyo & Aregbeshola, 2014). By understanding these challenges and developing solutions that are tailored to the local market, ICT companies can create value for their customers and gain a competitive edge.

In addition, South African ICT companies can leverage their brand reputation and customer base to create sustained competitive advantage. For example, Vodacom, a leading mobile network operator in South Africa, has built a strong brand reputation and customer loyalty through its innovative products and services, customer-centric approach, and investments in network infrastructure (Binuyo & Aregbeshola, 2014). Furthermore, the South African government has recognized the importance of the ICT industry and has launched initiatives to support its growth. For example, the government's National Integrated ICT Policy White Paper aims to promote digital inclusion, support local content development, and create a favorable policy

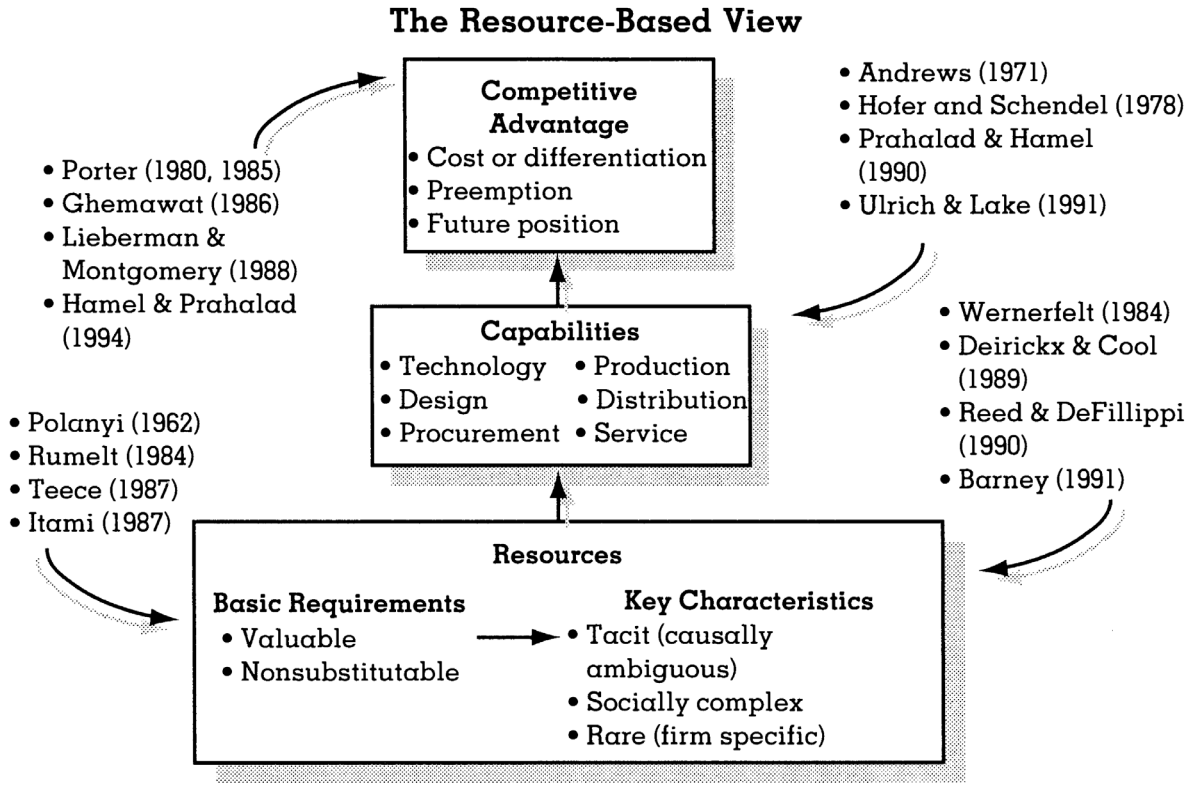
environment for the ICT industry. By aligning their strategies with these government initiatives and leveraging their unique resources and capabilities, South African ICT companies can create sustained competitive advantage and contribute to the growth of the industry.

In conclusion, the resource-based view theory is highly relevant in the South African ICT industry. By developing and leveraging their unique resources and capabilities, companies in the industry can create value for their customers, differentiate themselves from their competitors, and gain a competitive edge. Furthermore, by aligning their strategies with government initiatives, South African ICT companies can contribute to the growth of the industry and the broader economy.

2.3.2. Enhanced resource-based view

There has been an active debate among management scholars regarding the relative importance of internal firm capabilities (Galbraith & Kazanjian, 1986a, 1986b; Peters, Waterman, & Jones, 1982; Prahalad & Hamel, 2000) as against environmental factors (Hannan & Freeman, 1977; Porter, 1990) to sustain competitive advantage. However there is evidence that both internal and external factors are crucial to competitive success (Fiegenbaum et al., 1996; Hansen & Wernerfelt, 1989). In fact, many scholars attempt to integrate both internal and external perspectives under the banner of the "resource-based" view of the firm (Barney, 1991; Wernerfelt, 1984). The RBV perspective is that valuable, costly-to-replicate firm resources and capabilities – both internal and external – provide the key sources of sustainable competitive advantage (S. L. Hart, 1995). The connection between a firm's capabilities and its competitiveness is well established in the literature as shown in Figure 8 below. One of the key capabilities identified there is technology.

Figure 7: Enhanced resource-based view

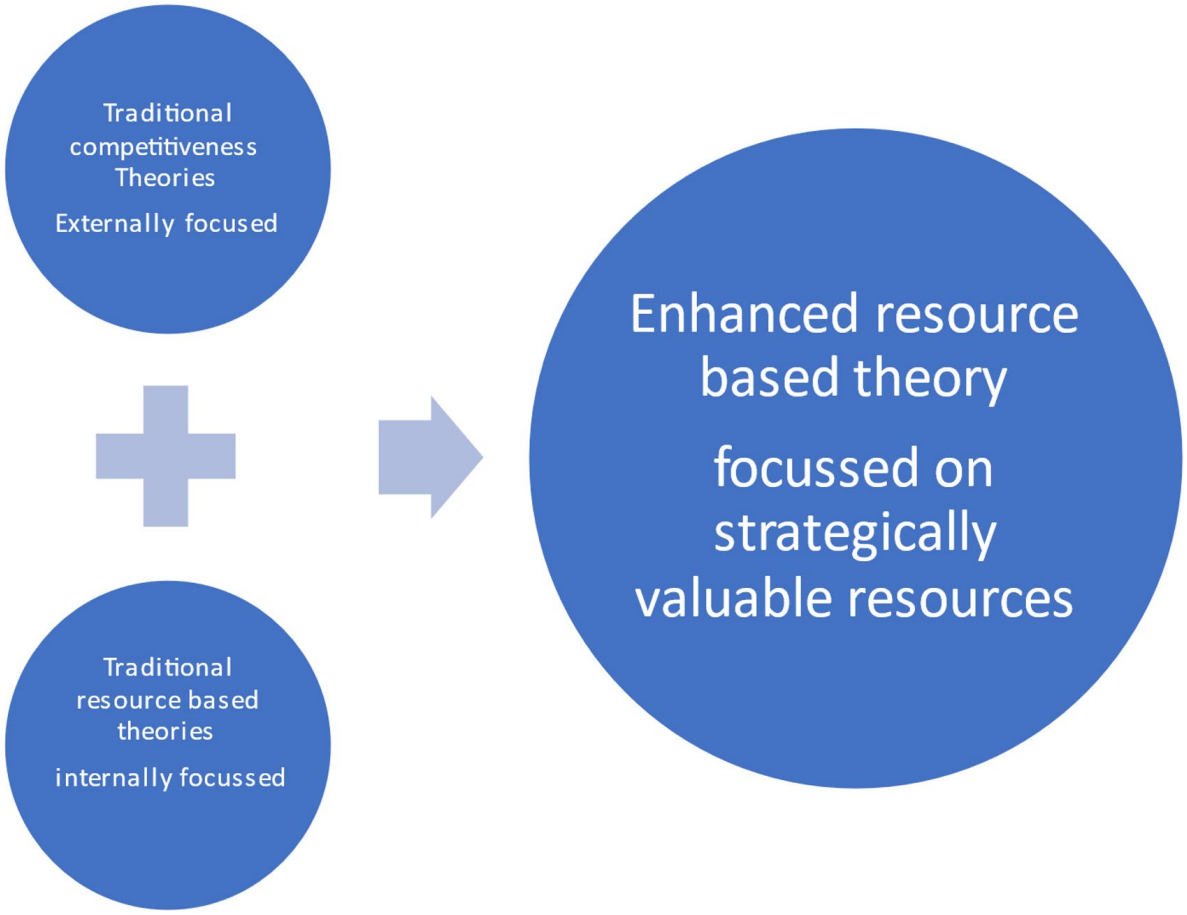


Source.(Stuart L Hart, 1995)

Collis and Montgomery (2008) amalgamate the strengths of Porter's externally focused Five Forces framework with those of the internally focused RBV. A firm's strategically valuable resources (SVRs) enable it to perform activities better or more cheaply than its rivals. However, resources cannot be evaluated in isolation, as their value is determined by the interplay with market forces. A resource that is a strategically valuable resource for an industry at one point in time may not be as valuable to another industry at another point in time. The enhanced RBV links a company's internal strategically valuable resources (SVRs) to its external environment (Collis & Montgomery, 2008).

Figure 9 below presents this researcher's construction of the enhanced resource-based view.

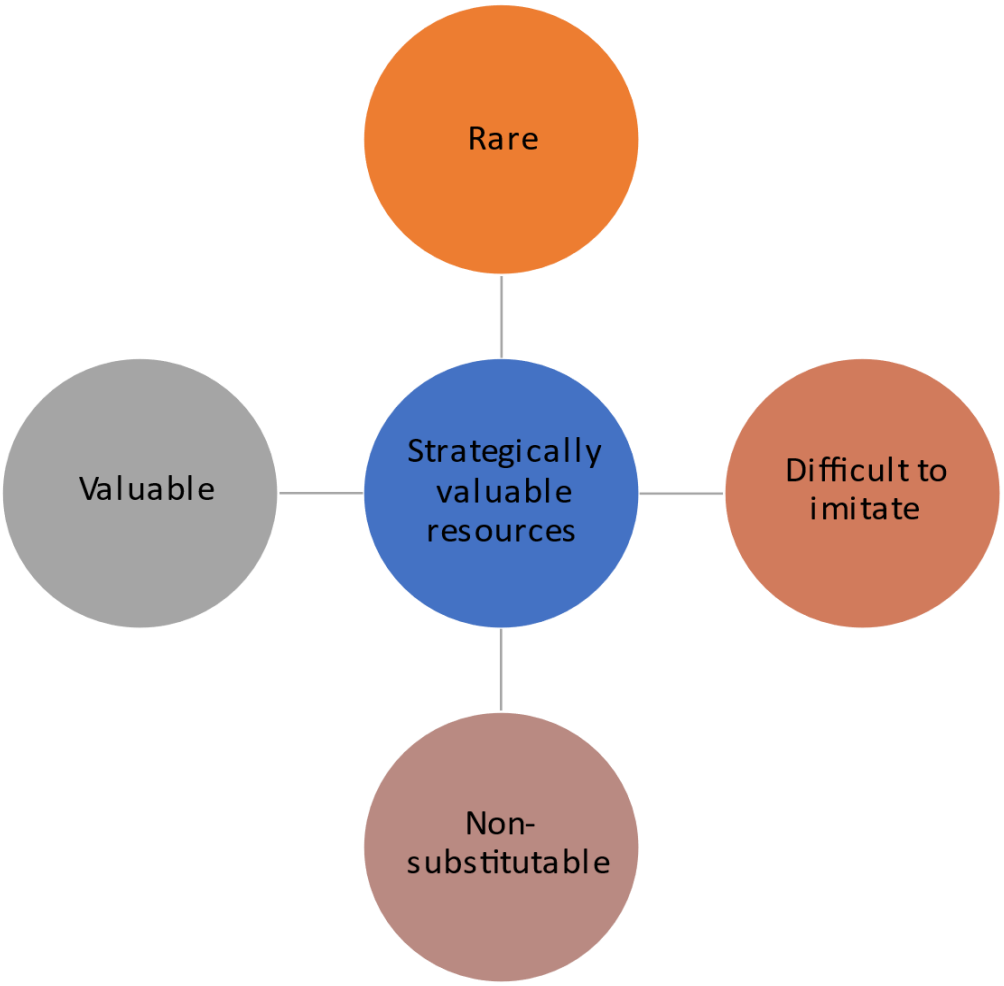
Figure 8: Evolution of enhanced resource-based view



Source: Collis and Montgomery (2008).

Characteristics of strategically valuable resources (SVRs) are shown in Figure 10 below. They are rare, valuable, difficult to imitate and non-substitutable (Barney, 1991).

Figure 9: Strategically valuable resources (SVRs)



Source: Barney (1991), Collis and Montgomery (2008).

2.4. Competitiveness in ICT industry

Technology is a key factor in deciding whether technology-intensive firms can succeed in a highly competitive market (Banwet, Momaya, & Shee, 2003). To achieve sustainable growth, firms must achieve technological competitiveness. Technology is surging forward and contributing to economic progress (Malana, 1993). Technological capabilities enable firms to achieve market superiority by producing products and services of a higher quality than competing companies. Country competitiveness is gaining importance across the world in the face of complex economic challenges. Most of the developed countries with high overall competitiveness have also high or medium

technological competitiveness. This implies that most of the countries with high overall competitiveness have already paid attention to their technological competitiveness (Mittal, Momaya, & Agrawal, 2013). The contribution of the ICT industry relates to increases in production and exports within the industry itself, as well as to the competitiveness of the economy overall. Competitiveness is synonymous with productivity and can be enhanced by rational utilization of, and investment in, resources, application of the latest knowledge, investment, increased operating efficiency, and implementation of modern production technologies. Competitiveness implies development of infrastructure and telecommunications, and intensive Internet usage (Cvijanović, Milojević, & Pejanović, 2012).

Firms in different countries are increasingly splitting up the technology value chain into different stages (Amighini, 2005). A computer may have semi-conductors made in the US by Intel, hard discs from Malaysia and memory chips produced in Korea with the final product being assembled in China.

The main problem of this research involves determining the strategically valuable resources (SVRs) required to develop the global competitiveness of South Africa's ICT industry.

The resource-based view believes firms are heterogeneous. Some theories such as Porter's Five Forces model are position–oriented, considering the industry as a whole rather than individual firms. In addition, Porter's Five Forces model considers firms in an industry as being homogeneous. By definition, however, ICT is diverse. Each firm will have its own competitive advantages. As such, the RBV is much more applicable to the competitiveness of ICT firms. However, the RBV was developed in the early 1980s and has since been enhanced. In 1980s competition was between firms within a country in the developing world, or between firms in the developed world. By 2018 globalisation had created multinationals that grew from both developed countries and emerging economies, so that now, competition is between multinationals, or between multinationals and local firms. This means a South African company is no longer merely competing with another South African company or a Western multinational. Such a South African company is also competing with multinationals from emerging

markets. This evolution is more pronounced in the ICT industry as a result of the rapid advances in ICT.

Emerging economies such as those of China and India have new, strategically valuable resources (SVRs). As shown in the following sections, these new strategically valuable resources (SVRs) are not only at firm level but at ICT industry level and at country level: this benefits firms and multinational. The RBV must therefore be adapted to the current ICT context. United States, Chinese, Indian and European ICT multinationals may have a competitive advantage over South African ICT firms as a result of their strategically valuable resources (SVRs). This study will therefore seek to determine those strategically valuable resources (SVRs) and address the research problem – “How to develop the competitiveness of the South African ICT industry” – through the application of the resource-based view of competitiveness in the modern context. A conceptual framework represents the linkages. According to Zuazua and Schulz (2018) future production of the strategically valuable resources (SVRs) needed to leapfrog to the 4IR will involve complexity, scale, technology and innovation, human capital, global trade and investment, institutional framework, sustainable resources and a demand environment.

2.5. Competitiveness of ICT MNCs

Giachetti and Lampel (2010) enhance the resource-based view by proposing a theory of strategic adjustment. Firms use the industry rivals and market leaders as reference targets for determining strategically valuable resources (SVRs). In this section, the competitiveness of ICT multinationals operating in South Africa is studied. These multinationals are the industry rivals and market leaders. There are Chinese, Indian, US and European multinationals involved in the South African ICT industry, providing software, hardware, services and support (Alden & Davies, 2006). Many MNCs operating in Africa have their headquarters in South Africa (Luiz & Radebe, 2016). Contemporary literature on multinationals in South Africa discusses the impact of these multinationals on the country (Renzi, 2013).

The leading Indian ICT company Tata Consultancy Services (TCS) has stated on its website that its clients include many leading South African business houses, financial institutions, telecom service providers, educational institutions and government organisations (TCS, 2017). TCS has also stated that eight out of ten financial institutions in South Africa use its core banking solution, BaNCS (Bell Administrative Network Communications System). Similarly, the world's number one telecommunications company, Huawei, dominates telecommunication infrastructure in South Africa (Huawei.com, 2018). On 18 April 2018 Huawei launched PowerStar for Africa, designed to reduce the energy consumption of radio network sites by between 10 and 15 percent, thereby reducing operator costs (Huawei.com, 2018). Huawei is constantly innovating the telecommunications infrastructure.

These developments show that ICT MNCs from emerging markets have a competitive advantage over the South African ICT industry in important sectors of the economy such as financial institutions and telecommunications. This applies even in the manufacturing sector, with the research centre for the luxury car producer Mercedes-Benz (now owned by Daimler AG) being primarily in Bangalore, India (Daimler.com, 2018).

2.5.1. Competitiveness of Chinese ICT MNCs

Major Chinese MNCs operating in South African ICT are Huawei, ZTE and Lenovo. Empirical research carried out in 2015 shows that the international competitiveness of the Chinese ICT industry ranks second among the top 15 countries with a high level of international competitiveness (Haichao & Shijie, 2015). Only Singapore is ahead of China.

According to Low (2005) China became the world's largest telecommunications market in 2003. Low (2005) also references the International Telecommunication Union's recognition of China as a telecommunications superpower. Before the 1980s China was heavily dependent on foreign companies for telecommunications equipment (Low, 2005). China followed the policy of "attracting-in" (Yinjinlai) and "walking-out" (Zouchuq) to attract ICT technologies and later export high technologies (Ning,

2009). In the early 1980s Zhongxing Telecommunication Equipment (ZTE) was formed in Guangdong as a state enterprise (Low, 2005). In 1987 Huawei was founded by Ren Zhengfei, a technician in the Chinese People's Liberation Army (De Cremer & Zhang, 2014). China considered telecommunication equipment supply to be a strategic asset and ensured that China's mobile operators bought equipment from ZTE and Huawei (Low, 2005). In addition, the Chinese Government applied constant pressure on foreign equipment suppliers to transfer knowledge to local vendors (Low, 2005). China's largest mobile operator, China Mobile, has given the bulk of its contracts to Huawei and ZTE (Lee & Lee, 2014). According to Lee and Lee (2014) China Mobile gave 34 percent of its 100 000 new base stations in China to ZTE and 31 percent to Huawei. In recent years the US government has followed a strategy designed to weaken Huawei as a serious competitor to US firms, both internally in the US and externally in other countries (Kastrenakas, 2018).

Ericsson was formerly the leading telecommunications equipment vendor globally (Jiang, 2005). Of Swedish origin, Ericsson has been operating for more than a century. According to Jiang (2005), Huawei stated in 2005 that it would take between ten and 20 years to catch up with leading players such as Ericsson, Nokia, Siemens and Cisco. But as per De Cremer and Zhang (2014), Huawei had achieved its target in fewer than 10 years. In 2012 Huawei recorded sales revenue of US$35,5 billion as opposed to Ericsson's sales revenue of $2,47 billion (De Cremer & Zhang, 2014).

Huawei and ZTE have been able to provide affordable equipment and capital financing (ProQuest, 2014). Both organisations have extremely efficient manufacturing and logistics operations to guarantee an efficient supply chain (De Cremer & Zhang, 2014). With their comparatively low manufacturing and logistics costs, Chinese multinationals can provide equipment at affordable prices. In addition, they have developed particularly efficient supply chains. More importantly, both Huawei and ZTE have been able to arrange financing for their equipment via state owned China Development Bank and Exim Bank of China (ProQuest, 2015). State owned banks are an important component of banking sector in China (Jia, 2009). These are strategically valuable resources (SVRs) for both Huawei and ZTE when competing with South Africa's ICT industry.

Huawei has a strong organisational culture in terms of work ethics and loyalty. The level of loyalty to the organisation and its management – especially Ren Zhengfei – is almost mystical (Tao & Chunbo, 2015). Huawei invested heavily in research and development. Thirty percent of Huawei's budget is spent on research and a similar percentage of Huawei staff are involved in research. Huawei has cultural and research capabilities that are distinct from the norms of South African industry. For instance, Huawei's organizational structure is led by its strategy and marketing department (Cooke, 2011). Key components of its business strategy are innovation, high quality, low cost and outstanding customer service. Customer focus strategy is realised through active engagement with customers, in this case network operators. This engagement includes setting up training centres for customers and inviting customers – potential and actual – to Shenzhen, in China's Guangdong Province.

The Chinese consumer electronics company Lenovo acquired its PC business from IBM 2004 as a strategic asset. This acquisition immediately made Lenovo the world's third-largest PC maker and also took over IBM's brand, managerial teams, R&D centres and distribution network (Deng, 2009). Since then Lenovo has grown to become the world's largest PC maker (Nylander, 2016).

Other leading Chinese MNCs are Alibaba, Xiaomi and Tencent. Xiaomi is a major rival to Samsung in the smartphone market.

Alibaba is the world‘s fourth-largest ICT company by market capitalization (Tse, 2015). In 2005 Taobao – founded just two years earlier as a member of the Alibaba group – took over from the multinational incumbent eBay to lead the market in China by leveraging its advantage in local knowhow. In that year, Taobao dominated China's customer-to-customer (C2C) online shopping market with up to 72 percent market share. By 2008 Taobao had created an e-commerce ecosystem consisting of 80 million registered users and more than 1 million sellers, third-party service providers in payment, logistics and verification, with a 400 000-strong network of web publishers in its affiliate marketing programme (Wu, Ma, & Shi, 2010). Researchers believe shared experience, business model innovations and resourcefulness are a company's strategically valuable resources (SVRs) for achieving latecomer advantage.

In summary, Chinese multinationals have strategically valuable resources (SVRs) such as supply chain, capital financing, innovation, organisational culture, research and development, and cost advantage among their capabilities. Education, research and development are all resources.

2.5.2. Competitiveness of Indian ICT MNCs

Among the major Indian MNCs in South African ICT is Tata Consultancy Services (TCS), India's largest MNC. In addition, India's second-largest ICT Company, Infosys, offers Business Process Management solutions to South African clients. Infosys operates from Johannesburg.

TCS was founded in 1968 as an IT consulting firm. Since then it has expanded to become a global player in IT offshore outsourcing, with revenue of more than US$4 billion in 20067. With more than 89 000 associates and 79 service delivery centres, TCS has established a presence in 34 countries. It provides various services, including business process outsourcing (BPO) and IT maintenance and development, to hundreds of clients around the globe (Oshri, Kotlarsky, & Willcocks, 2008). TCS management has been applying "planned opportunism" in ICT for many years. TCS saw that technologies were moving to the cloud, allowing business services to be delivered as an online utility rather than through traditional enterprise-owned technology infrastructures. TCS also correctly forecast that global businesses would eventually demand higher-level, more strategic, outsourced services (Govindarajan, 2016). Sales revenue per employee tended to be higher for higher-value-added services, so by focusing on those services, TCS could significantly improve profits with a smaller workforce. Furthermore, TCS management knew that TCS needed to attract increasingly sophisticated talent, which would require major recruitment efforts. The success of TCS is so pronounced that the TCS chief executive officer, Natarajan Chandrasekaran, was promoted to CEO of the Tata conglomerate in 2017 (Bhattacharya, 2017).

In addition to AI, Tata Consultancy Services, as the leading Indian ICT MNC, has listed big data, cloud, cyber security and the Internet of Things (IoT) as its main technology

drivers (TCS, 2018). TCS even abandoned its successful call centre operations to focus on its main technology drivers, an example of what is known in the business world as “planned opportunism” (Govindarajan, 2016). TCS implements a reuse methodology at the global level and continuously measures the contribution of reusable software assets (Oshri et al., 2008). Reuse of software modules and building reusable software libraries are important elements in the growth of India’s ICT industry.

Indian competitiveness depends on skill-intensive tradable services such as software development, IT-enabled services, product/project engineering and design, biotechnology, pharmaceutics, media, entertainment and health care. India’s strength lies in the large pool of highly skilled, English-speaking ICT knowledge workers who are available at a low cost compared to US or European knowledge workers (Dahlman & Utz, 2005; Kapur & Ramamurti, 2001). India also has a valuable diaspora that helps create necessary networks. However, this impacts the growth of a host country’s knowledge workers and employment.

According to Chakraborty (1997) Indian workers prefer a highly authoritative and hierarchical style of management and respond favourably to close supervision. This is despite the influence of Western MNCs on Indian MNCs. In addition, cultural management is an important aspect of Indian society as India is deeply religious and people’s behaviour is influenced by religious norms, values and beliefs. These aspects are further embodied in the business practices of Indian MNCs. In order to create high levels of motivation, job descriptions and detailed instructions must be provided.

Indian MNCs have distinctly different work ethics from those of other Asian MNCs, specifically MNCs from East Asia. East Asian work ethics follow Confucian values (benevolence, harmony, learning, loyalty, righteousness and humility) whereas Indian work ethics are based on friendship, loyalty, decisions being made at the top, and intuitive ethical decision-making (Ardichvili et al., 2012). Compared to other MNCs around the world, Indian MNCs emerged from a highly regulated environment (Alden & Davies, 2006). Compared to other Asian countries, Indian MNCs had very little government support. India was never a closed society and the country has English-speaking international travelling executives as is the case with executives from the US or Europe. With their Westernised business practices, Indian MNCs can integrate with

the global economy much more easily than Chinese, East Asian, Russian or even Brazilian MNCs. Indian managers are more market-friendly and globally aware than their counterparts in other Asian countries (Khanna, Palepu, & Sinha, 2005). These facets present as cultural capabilities.

Talib, Rahman, and Akhtar (2013) state that top management's commitment to Total Quality Management (TQM) achieves the highest scores for Indian ICT companies, with such commitment being perceived as of the highest importance for Indian ICT companies. Furthermore, Indian software management and developers are highly committed to TQM.

According to Khanna and Palepu (2004) 70 percent of the cost structure of a software company involves personnel costs. India produces more engineers and scientists than any other country in the world except the US. Communication and infrastructure are other capital requirements.

Many major MNCs have established research and development centres in India. One example of R&D in India is the establishment by General Electric of the world's largest R&D lab (outside the US) in Bangalore (Kapur & Ramamurti, 2001). This R&D lab employs 2 600 scientists including 300 with doctoral-level qualifications. Indian MNCs have been utilising Outward Foreign Direct Investment (OFDI) to acquire highly innovative firms in the developed countries to build their own technological competitive edge (Pradhan, 2007). However the acquisition of foreign technological knowledge can be seen as a double-edged sword. On one hand, Indian MNCs need not develop Indian R&D. On the other hand, these MNCs will have to develop local R&D to integrate the foreign technical knowledge with their local technical knowledge.

Dayasindhu (2002) contends that embeddedness and knowledge transfer are the key determinants of the Indian ICT industry that led to global competitiveness. Behavioural drivers of transaction cost economics such as trust and experience influence embeddedness. This describes the relationships among organizations in an industry cluster. The spiral of knowledge transfer, culture variables and embeddedness influences knowledge transfer.

In summary, the strategically valuable resources (SVRs) of Indian MNCs are innovation, high value-added services, leveraging the diaspora, organic knowledge transfer, embeddedness, organisational culture, work ethics and loyalty.

2.5.3. Competitiveness of US ICT MNCs

The United States is the No 1 country for global competitiveness (Klaus, 2019). Major US ICT multinationals in South Africa include Intel, Cisco, Microsoft, Google, Oracle, HP and IBM.

Intel has progressed from being a component (chip) maker to becoming a major source of influence in personal and server computer architecture, and then on to becoming a platform leader (Gawer & Cusumano, 2002). This was brought about by the ever-growing demand for computing power necessitated by software advances. Intel experienced poor demand because of the outmoded nature of PC architecture in the early 1990s. However Intel overcame this to became a platform leader by establishing its own Intel Architecture Lab (IAL). IAL was instrumental in achieving architectural progress on PCs, facilitating innovation for its supporting products, and coordinating innovation outside Intel to produce new system capabilities (Gawer & Cusumano, 2002).

Microsoft dominates the software side of the PC platform with its MS-DOS and Windows operating systems. Microsoft realised the importance of additional applications (Gawer & Cusumano, 2002). This was where its strategy of “platform leadership” differed from that of Intel. Microsoft’s strategy was to rely on making its own complementary programs such as Word, Excel, Outlook, e-mail, scheduler and other applications bundled with Windows.

Cisco became a platform leader by providing a major part of the infrastructure hardware and software for the Internet. Cisco is to the Internet what Intel is to microprocessors and Microsoft is to PC software. The company’s strategy was to allow interoperability between Internet routers and other types of communications technologies (Gawer & Cusumano, 2002). However, unlike Intel and Microsoft, Cisco had many competitors, and it became a platform leader by acquiring and integrating

its competitors and substitutes. The four key elements of its strategy are providing complete solutions for customers by becoming a one-stop shop for networks, acquiring the products for making complete solutions, defining industry standards for networking protocols, and forming alliances and partnerships with complementors and competitors (Lu, Huang, & Heng, 2006).

From the start, Google founders Sergey Brin and Larry Page required all software engineers working for the company to spend 20 percent of their work time (one day a week) working on whatever projects were of interest to them. They thought this would send a message to bright people to come and work for Google. Both Brin and Page's parents were university academics who similarly spent one day a week doing their own research (Vise, 2007).

Apple was able to reshape its environment by creating and deploying products such as the iPad and iPhone that integrated features such as a cellphone, music player, digital camera and computing. Apple was able make use of innovation as a capability (Johnson, Li, Phan, Singer, & Trinh, 2012). Apple's vision is: "Apple is committed to bringing the best personal computing experience to students, educators, creative professionals and consumers around the world through its innovative hardware, software and Internet offerings."

In the 1980s Silicon Valley started utilising Indian IT companies, primarily based in Bengaluru, for low-cost software development. Subsequently, major US IT MNCs opened research and development centres in India. They included Microsoft, Oracle and others. At the same time older unrelated Indian industries such as Tata Consultancy Services (TCS) were diversifying into software services (Khanna & Palepu, 2004). There were also new start-ups such as Infosys. India's initial entry into the software industry was primarily aided by low costs. In addition, Indian software professionals are globally more mobile. Forty percent of the H-1B speciality occupation visas issued by the US to foreign talent go to Indian applicants.

The California-based Hewlett-Packard (HP) had an excellent relationship with Intel from 1994 (Rosenbladt, 1998). This strategic relationship ensured that both companies worked together to develop the Merced chip processor. Although each had

independent and successful architecture, their collaboration saved investment costs and produced industry standards. HP's capabilities are a strategically balanced portfolio of products and services such as servers and laptops, and research and development (Marketline, 2015a). In addition, HP is also moving into cloud computing and big data services.

IBM (International Business Machines), headquartered in New York, is almost a century old (Haigh, 2018). IBM is the leader in the field of supercomputers. Although IBM ventured into personal computers and operating systems, these proved disasters. In 1993 IBM declared what was, at that point, the largest annual loss of any company in history – $5 billion. Despite this, IBM moved away from mass-market hardware and towards business services. IBM also fostered a distinct corporate culture and took the lead in organizational innovations. IBM also has the largest design team in the world. These capabilities helped IBM to recover and become one of the world's leading ICT MNCs (O'Keefe, 2018). Today IBM is heavily involved in cognitive technologies and cyber security.

Both IBM and Apple took a dual-transformation approach. In the mid-1990s IBM remodelled its mainframe business, shifting from proprietary systems to servers running software based on open standards. At the same time, it built a separate global services organization that became a source for future growth (Gilbert et al., 2012). In the late 1990s Apple repositioned its struggling PC business, trimming offerings and focusing on design. Shortly afterwards it launched the iPod and opened its iTunes stores, which led to huge growth.

In summary, US ICT multinationals have used innovation in technology and business as their strategically valuable resources (SVRs). Some of their strategically valuable resources (SVRs) include research centres in India, resources from India and brand value.

2.5.4. Competitiveness of European ICT MNCs

One of the largest European ICT multinationals in South Africa is Ericsson. At one point Ericsson was the largest telecommunications company in the world and in South

Africa (Wickman, 2018). Ericsson installed four telephone exchanges in South Africa between 1896 and 1900, making it Ericsson's largest market for exchanges outside Europe. Ericsson has a strong research and development component and has been adopting cloud computing to enhance its technological capabilities (Marketline, 2015b). Before undergoing transformation in 2004, Ericsson operated as a decentralised structure with its own issues such as cost control, competencies and consolidation. Then Ericsson transformed itself into ten shared service centres as a form of "internal outsourcing" (Iveroth, 2010). Ericsson also replaced multiple Enterprise Resource Planning systems with a single ERP system. Ericsson standardised global processes and these become part of the ERP system. It also further diversified its business by shifting the focus from telecommunications to cloud computing and other emerging technologies.

2.5.5. Competitiveness of South African ICT companies

BusinessTech has listed 25 top companies in South Africa according to their market capitalisation (These are, 2018). Although the list contains companies that utilise ICT, only Vodacom (placed as No. 10) and the MTN group (No. 12) can be considered to be ICT companies. Standard Bank (No. 9), Absa (No. 15) and Nedbank (No. 18) can be considered as semi-ICT companies owing to their extensive application of ICT such as software development, telecommunications and facilities management. Telkom SA is listed at 66th place in the top 100 companies. Denel is a state-owned ICT company and as such is not listed for market capitalisation. This contrasts with Western and emerging countries where ICT companies are clustered among the top such.

South Africa has started developing and applying the emerging technologies. The South African Reserve Bank successfully completed Blockchain proof of concept (SARB, 2018). Proof of concept demonstrated a capability to process twice as many transactions as the current system in the same time frame. The Commonwealth Bank of Australia (CommBank) has proposed importing the "commercialised Blockchain solution" successfully tested in South Africa (Nott, 2018). De Beers has started using Blockchain to span the entire diamond value chain (Anglo American, 2018). Blockchain technology is one of the emerging digital technologies. Tari Labs, a South

African start-up, is promoting its Tari Blockchain protocol for use in ticketing applications in the US (McKane, 2018). Another emerging technology, cloud computing, is yet to become fully utilised by South African businesses (Pazvakavambwa, 2018). South Africa is using drones to prevent crime at construction sites (Chutel, 2018). Other reports concern drones being used to fight poaching in Southern African nature reserves (Fintan, 2020; Pienaar, 2015). The Cape Town University of Technology (CPUT) launched an advanced microsatellite in April 2018 (CPUT, 2018). South Africa's Square Kilometre Array telescope includes multiple technologies (Gastrow, Kruss, & Petersen, 2016). The South African Government has signed agreements with independent power producers (IPPs) to procure alternative environmental-friendly electricity (Sibongile, 2018). These agreements include wind farms using wind turbines …an emerging technology.

From 1999 the University of Stellenbosch has been launching the SUNSAT series of microsatellites (Montenbruck, Nortier & Mostert, 2004). The primary objectives of these microsatellites are the collection of remote sensing data for agriculture, health (malaria) monitoring, disaster mitigation and infrastructure planning in South Africa.

To conclude this section, there are emerging technologies available for the South African ICT industry to develop global competitiveness. The industry has the capability to adapt emerging technologies to local requirements. There is limited literature on the global competitiveness of the South African ICT industry, also limited literature on the existing strategically valuable resources (SVRs) and required strategically valuable resources (SVRs) in the industry. These resources must be determined by an empirical study.

2.5.6. The role of ICT Competitiveness in economic development in South Africa

Information and Communication Technology (ICT) plays a vital role in the economic development of South Africa. The country's ICT sector has seen significant growth in recent years, driven by various factors such as increasing demand for ICT products and services, infrastructure development, and favorable government policies. ICT competitiveness has been a key driver of this growth and has contributed to job creation, innovation, and entrepreneurship. One of the primary ways in which ICT

competitiveness has contributed to economic development in South Africa is by creating jobs. According to a report by the International Data Corporation (IDC), the ICT sector is one of the largest employers in the country, accounting for over 450,000 jobs in 2019. These jobs are spread across a wide range of industries, including telecommunications, software development, and hardware manufacturing. The report further highlights that the ICT sector has the potential to create even more jobs in the future, particularly in areas such as cybersecurity and cloud computing.

ICT competitiveness has also played a crucial role in promoting innovation and entrepreneurship in South Africa. The country has a vibrant startup ecosystem, with a growing number of technology startups emerging each year. Many of these startups are focused on developing innovative products and services that leverage new technologies, such as artificial intelligence (AI) and blockchain. ICT competitiveness has enabled these startups to access new markets, enhance their productivity, and improve their product quality, thereby promoting innovation and entrepreneurship in the country.

Furthermore, ICT competitiveness has contributed significantly to the country's GDP. According to a report by the World Bank, the ICT sector contributed to 7.9% of South Africa's GDP in 2017, highlighting the sector's importance to the country's economy. The report further highlights that the adoption of new technologies, such as cloud computing and big data analytics, has contributed to the sector's competitiveness and has enabled the country to keep pace with global trends.

Also, there is a growing body of literature that supports the idea that ICT competitiveness plays a crucial role in the economic development of South Africa. In this section, we will review some of the empirical studies that have been conducted on the topic. According to a study by Munyua and Were (2019), the ICT sector in South Africa has played a significant role in driving economic growth, job creation, and poverty reduction. The study found that the ICT sector contributed to 7.9% of South Africa's GDP in 2017, and that the sector created approximately 472,000 jobs during the same period. The study further highlighted that ICT competitiveness was a key driver of the sector's growth and that the adoption of new technologies, such as cloud

computing, big data analytics, and the Internet of Things (IoT), had contributed significantly to the sector's competitiveness.

Another study by Mokwena and Zikhali (2019) examined the role of ICT competitiveness in promoting innovation and entrepreneurship in South Africa. The study found that ICT competitiveness had a positive impact on innovation and entrepreneurship, as it enabled firms to access new markets, enhance productivity, and improve product quality. The study further highlighted that ICT competitiveness was particularly important for small and medium-sized enterprises (SMEs) in South Africa, as it enabled them to compete with larger firms and gain a foothold in the market.

A more recent study by Mudau et al. (2021) examined the impact of ICT competitiveness on economic development in South Africa, using panel data analysis. The study found that ICT competitiveness had a positive and statistically significant impact on economic development, as measured by GDP per capita. The study further highlighted that the impact of ICT competitiveness on economic development was stronger in provinces with higher levels of ICT infrastructure, such as Gauteng and Western Cape.

In conclusion, the empirical evidence suggests that ICT competitiveness plays a crucial role in the economic development of South Africa. The ICT sector has contributed significantly to the country's GDP, job creation, and poverty reduction, and has enabled firms, particularly SMEs, to innovate and compete in the market. Furthermore, the adoption of new technologies has contributed to the sector's competitiveness and has enabled the country to keep pace with global trends. These findings highlight the importance of continued investment in the ICT sector and the need for policies that promote ICT competitiveness in South Africa.

2.5.7. Government regulations

The emergence of environment-friendly alternative energy technologies is an indication of effective government environmental regulations. Technologies such as biofuels, electric vehicles, wind turbines and hydrogen energy are the outcome of

government environment regulation (Schwab, 2010). There is strong evidence of a relationship between regulation and competitiveness (Porter & Van der Linde, 1995). Environment-friendly government policies and regulations have led to emerging technologies in the 4IR. Other studies, such as those on US manufacturing, conclude that environmental regulation does not impact competitiveness negatively (Jaffe, Peterson, Portney, & Stavins, 1995).

Government intervention to protect an industry may not be in the best interests of the country concerned (Krugman, 1992). Though strategic trade policy uses interventionist regulations to help domestic firms, at a country level this may lead to counter-reaction by other countries and thus set off a cycle of protectionism (Smit, 2010). This has been seen in the case of recent trade wars between the US and other developed and emerging countries. Government interventions on ICT infrastructure in a bid to assist local ICT industries have been repeated many times around the world (Lucas, Sands, & Wolfe, 2009). A primary example is the setting up of ICT clusters. The Indian Government played a major role in setting up ICT clusters in Bangalore, Hyderabad and Chennai (Grondeau, 2007). Similarly, the Chinese Government played a major role in setting up an ICT cluster in Shenzhen (Wang, Lin, & Li, 2010). Overall, government regulations and policies can play a major role in the development of global competitiveness by the South African ICT industry despite the negative potential of certain policies. An example is the role played by the Competition Commission in South Africa when it embarked on an inquiry into data costs (Phillips, 2018). The commission made recommendations at the conclusion of the inquiry and costs for unbundled data were lowered (Gavaza, 2020).

2.6. Gap Analysis

The literature reviewed has exposed a number of gaps. Firstly, few studies have addressed the global competitiveness of South Africa's ICT industry. Secondly, there is limited literature on the application of resource-based theory or an enhanced resource-based view to consider the global competitiveness of an industry, including the ICT industry. However, there is literature on the application of the RBV to business/ICT alignment in European organisations (Cumps et al., 2006; Maes et al.,

2000). Thirdly, there is limited research available on the competitiveness of MNCs over their local counterparts in the ICT industry. Fourthly, there is limited literature on the impact of external factors such as multinationals and government interventions on the application of resource-based theory or an enhanced resource-based view of an industry, including the ICT industry. Finally, there is limited contemporary literature available on the strategically valuable resources (SVRs) required to develop the global competitiveness of the ICT industry, including South Africa's ICT industry. Current theories on positioning, such as Porter's Five Forces model, are limited in their application to competitiveness in the ICT industry, which is both heterogeneous and rapidly evolving. However, the enhanced resource-based view considers an industry to be heterogeneous. As such, the gaps identified warrant the need to study South Africa's ICT competitiveness using an enhanced resource-based view as a foundation to determine the strategically valuable resources (SVRs) required to develop the global competitiveness of South Africa's ICT industry.

2.7. Conceptual Framework

As indicated in this review, there are two schools of thought regarding competitiveness. One is the position-oriented school of thought and the other is the resource-based view school.

The resource-based view considers an industry to be heterogeneous. Position-oriented theories such as Porter's Five Forces model consider an industry as being homogeneous. However the ICT industry is heterogeneous. The RBV looks at internal capabilities required to become competitive, while position-oriented theories look at external factors required to become competitive. Porter's Five Forces model, which is the paramount position-oriented theory, includes the threat of new entrants and the threat of substitutes as two of the forces (Dess et al., 2011). The fourth industrial revolution includes 40 ICT technologies (Schwab, 2017). With its rapidly evolving technologies, the ICT industry will constantly and frequently face the threat of new entrants and substitutes.

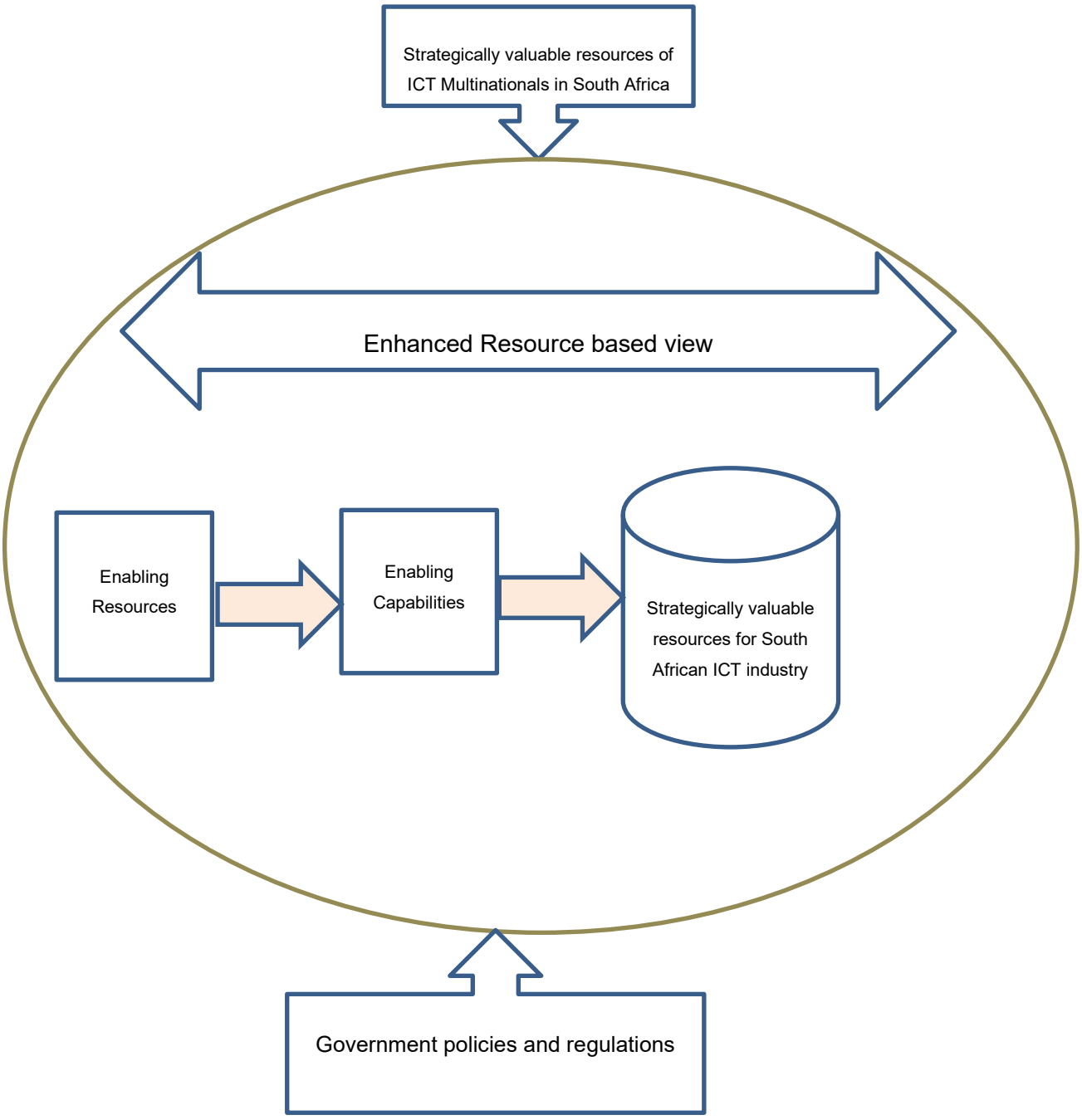
Resource-based views were developed in the early 1980s and have since been enhanced. The enhanced resource-based view considers both internal and external capabilities. In the 1980s competition was between firms within a country in the developing world or between firms in the developed world. By 2018, globalisation had created multinationals from both developed countries and emerging economies: competition is now between multinationals or between multinationals and local firms. This means a South African company is no longer merely competing with another South African or a Western multinational, instead it is also competing with multinationals from emerging markets. This evolution is more pronounced in the ICT industry as a result of the rapid advances in ICT. These advances have led to highly competitive multinationals from emerging countries such as China and India acquiring the latest technologies and then supplying products to South Africa. For example, 15 years ago Ericsson and the joint Nokia Siemens venture were the market leaders in telecommunications equipment. Now Huawei is the market leader in telecommunications equipment as technology has rapidly evolved from 3G to 5G.

Emerging economies such as China and India have new, strategically valuable resources (SVRs) not only at firm level but at ICT industry level and at country level: this benefits their firms and their multinationals. Thus the RBV must be adapted to the current ICT context. One concept derived from the literature is that US, Chinese, Indian and European ICT multinationals may have gained competitive advantage over South African ICT firms as a result of their strategically valuable resources (SVRs). This study will therefore seek to determine these strategically valuable resources (SVRs) and address the research problem – “How to develop the competitiveness of the South African ICT industry” – through the development of a resource-based view of competitiveness in the modern ICT context. According to Zuazua and Schulz (2018) future production capabilities for a speedy advance to the 4IR involve complexity, scale, technology and innovation, human capital, global trade and investment, institutional framework, sustainable resources and demand environment.

A conceptual framework is a system of concepts, assumptions, factors, expectations and belief that supports and informs a research project (Rao & Troshani, 2007). Figure 11 below depicts the conceptual framework of linkages and contributory factors

determining the strategically valuable resources (SVRs) required to make South Africa's ICT industry globally competitive. The framework's foundation is an enhanced resource-based view. The enhanced resource-based view is built from the ground up in the context of South African ICT to determine the strategically valuable resources (SVRs) required to render South Africa's ICT industry globally competitive. Major inputs are the competitiveness of ICT multinationals and government regulations and policies.

Figure 10: Conceptual framework



Source: Author's construction

2.8. Conclusion

In conclusion, this study has shown that ICT competitiveness plays a crucial role in the economic development of South Africa. The country's ICT sector has seen significant growth in recent years, driven by various factors such as increasing demand for ICT products and services, infrastructure development, and favorable government policies. The study has highlighted the contributions of ICT competitiveness to job creation, innovation, entrepreneurship, and GDP growth in the country. This chapter began with an examination of the concept of competitiveness. It then examined the resource-based view and rationalised the enhanced resource-based view as the most suitable theoretical framework to consider the competitiveness of South Africa's ICT industry and ICT firms. It next proceeded to examine the literature covering the ICT competitiveness of US, Chinese, Indian and European ICT multinationals. The review also identified possible strategically valuable resources (SVRs) of the ICT MNCs from the literature consulted.

However, there are still some gaps that need to be addressed. For instance, there is a need for more investment in ICT infrastructure and human capital development. The country also needs to address issues such as the digital divide and cybersecurity threats, which can hinder the growth of the ICT sector. Furthermore, there is a need for more policies that promote ICT competitiveness and support the growth of startups and small and medium-sized enterprises (SMEs) in the sector.

In conclusion, the study has shown that ICT competitiveness is critical for the economic development of South Africa. The sector has the potential to drive growth, create jobs, and promote innovation and entrepreneurship. However, there is a need for more investment in ICT infrastructure and human capital development, as well as policies that support the growth of startups and SMEs in the sector. Addressing these gaps and challenges will be crucial to ensure that South Africa remains competitive in the global economy.

In the next chapter, research methodology for this research is explained in detail with emphasis on the application of grounded theory.

Chapter 3: Research Methodology

3.1. Introduction

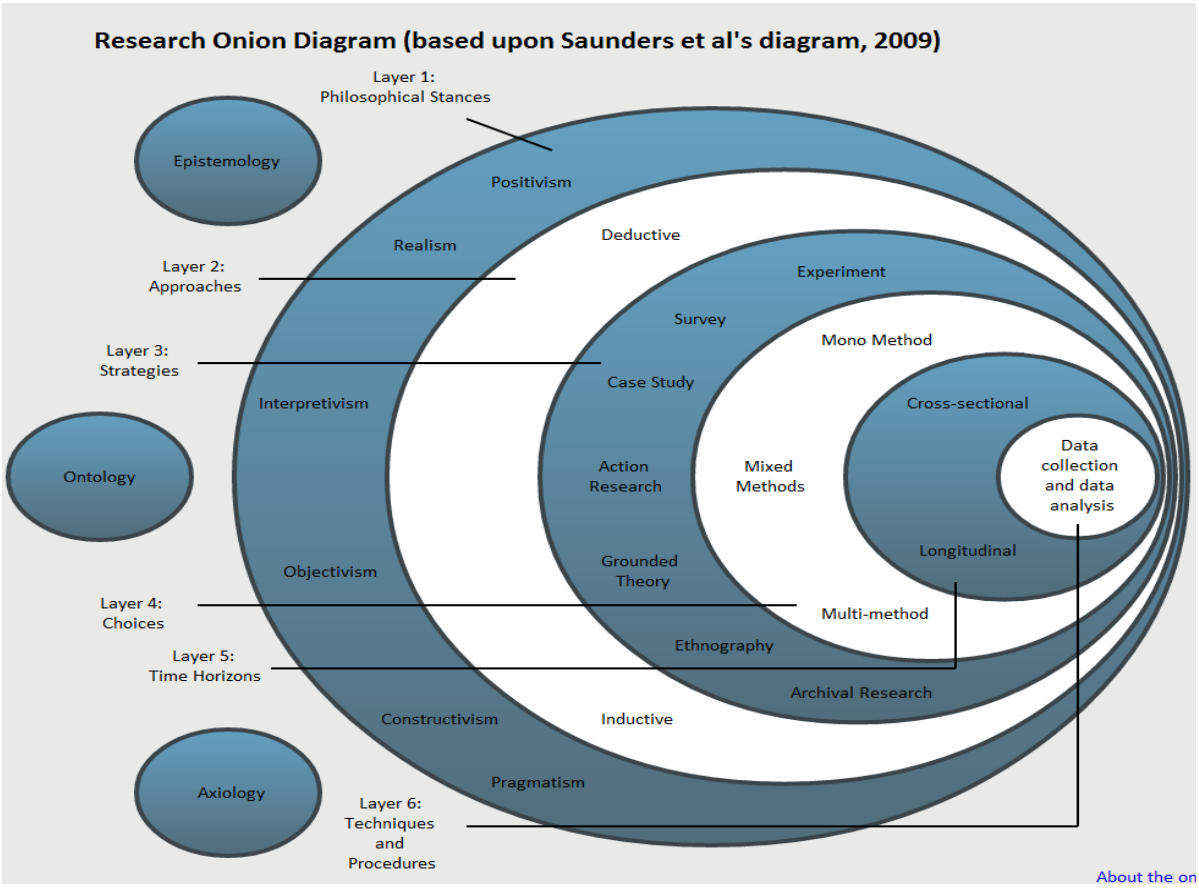
Research methodology is a systematic design to solve a research problem and answer the research question (Kothari, 2004). The Research Onion diagram below, based on Saunders, Lewis & Thornhill (2009), provides an overview of the research methodology for this study. When evaluated from the outer layer, the Research Onion depicts various stages of the research process.

The current research is to be undertaken using in-depth interviews with the relevant strategic decision makers in various organizations and firms representing both state and private sectors in South Africa. The study requires understanding of the topic, the problems and the research questions. As such the research needs to be conducted with the participation of relevant strategic decision makers such as ICT or business executives in ICT multinationals, and South African ICT industry leaders. Qualitative research is the research paradigm to be used in this study as the aim is to understand the experiences, perspectives, ideas and attitudes of the respective strategic decision makers.

In this study the Research Onion of (Saunders, Lewis and Thornhill, 2009) guides the research method stages.

3.1.1. Research Onion

Figure 11: Research Onion



Source: Saunders et al. (2009).

Stages in the development of this research are based on the six layers as illustrated in the Research Onion. Each layer constitutes a stage.

3.2. Stage 1 – Research Philosophy

This study makes a significant empirical, theoretical and methodological contribution to the existing body of knowledge as detailed under the significance of the study in section 1.6. of Chapter 1.

The research philosophy provides the researcher with guidance, direction and structure during the entire life cycle of the research (Saunders, Lewis, & Thornhill,

2016). The Research Onion prescribes research philosophies that are studied in the context of ontology, epistemology and axiology. However these theories have an impact on what is being researched and how the research is being interpreted. Existing knowledge about the area being researched, in the form of a literature review, forms an important background to the research. A researcher's view about the nature of relationship between theory and research also impacts research (Fawcett & Downs, 1986). Assumptions and views about how the research should be conducted also impact the research process. Axiology helps the researcher appreciate the fact that the researcher's views affect the collection and analysis of research data (Smith, 2017).

This study acknowledges the influence that the three philosophies might have throughout the research. Saunders et al. (2016) indicate that linked to the three philosophies are philosophical approaches that influence the stages of the research process.

Figure 13 below presents comparisons of two principal research paradigms.

Figure 12: Research paradigms

	Positivism-oriented		Interpretivism-oriented	
	Positivism	Post-positivism	Interpretivism	Constructivism
Ontology: What is reality?	Naïve realism. Objective reality.	Critical realism. Reality is imperfectly apprehendable.	Subject and object are dependent. The real essence of the object cannot be known. Reality is constructed.	
Epistemology: How do you know?	Dualism researcher-research. Replicable findings are "true". Reality can be explained.	Dualism is not possible. Replicated findings are "probably" true. Impossible to fully explain reality.	Knowledge is interpreted. Reality can be understood.	Knowledge is constructed. Reality can be constructed.
Methodologies: How do you find it out?	Experimental, deductive. Mainly quantitative. Relationship cause-effect. Statistical analysis.	Experimental. Mainly quantitative methods, manipulative. Scientific Community plays an important role of validation. Statistical analysis. Probability sampling.	Interpretation. Mainly qualitative methods. Purposive and multipurpose sampling.	Mainly qualitative methods. Purposive and multipurpose sampling. Stakeholders involvement.
Goodness or quality criteria	Rigorous data produced through scientific method.	Statistical confidence level and objectivity in data produced.	Intersubjective agreement and reasoning reached through dialogue, shared conversation and construction.	

Source: Iofrida, De Luca, Strano, & Gulisano (2014).

3.2.1. Why Qualitative research?

The research objectives are:

a) To understand the competitiveness of the South African ICT industry compared to ICT multinationals operating in South Africa; and
b) To determine the strategically valuable resources (SVRs) required to develop the competitiveness of the South African ICT industry.

The research questions are:

Primary

What are the strategically valuable resources (SVRs) required by South African ICT companies to develop the global competitiveness of the South African ICT?

Secondary

- What is the current competitive status of the South African ICT industry?
- What are the current strategically valuable resources (SVRs) of the South African ICT industry?
- What are the current strategically valuable resources (SVRs) of the ICT multinationals that are competing with the South African ICT industry?

Qualitative research is the most suitable method to address the research objectives and answer these questions.

In addition, qualitative research methodology was chosen as this study is not intended to test a theory. Instead, it is developing enhanced resource-based theory to determine strategically valuable resources (SVRs) in South Africa's ICT industry to develop the competitiveness of the industry. Only experts in the ICT industry can contribute to the determination of strategically valuable resources (SVRs). Their opinions and views have to be interpreted. The research philosophy for this qualitative research is interpretivism.

Ritchie, Lewis, Nicholls, and Ormston (2013) state that the aims and objectives of qualitative research are to provide an in-depth and interpreted understanding of the social world. Qualitative research also uses non-standard and adaptable methods of data generation. The origins of qualitative research lie in interpretivist thinking. Yin (2015) states that undertaking qualitative research means comprehending that it is a craft and engaging in original research. It has three important objectives. These are transparency, being methodical, and adherence to evidence in the process of data collection and analysis. Five important features distinguish qualitative research from other forms of research. Firstly, qualitative research studies the meaning of people's

lives in the real world. Secondly, this research represents the views and perspectives of participants. Thirdly, it explicitly attends to, and accounts for, real-world contextual situations. Fourthly, it contributes insights from existing or new concepts. Finally, it acknowledges the potential relevance of multiple sources. According to Antwi and Hamza (2015) the epistemological position of qualitative research is considered to be interpretivist and inductive. This is in sharp contrast to quantitative research, which adopts a natural scientific model and positivism. In qualitative research the focus is on understanding the social world through an examination of interviewees' interpretation of that world.

This study examines how to develop the competitiveness of the South African ICT industry, together with the reality behind the details and multiple views of participants (Denscombe, 2014). Participants have an opportunity to tell their stories in a way that accurately represents their experiences (Creswell, 2013) and subjective meanings are regarded as acceptable knowledge in this study (Saunders et al., 2009). At the ontological level this research will be based on the interpretivist philosophy, a philosophy that accepts multiple realities of a phenomenon (Creswell, 2013). Interpretivism uses qualitative methods where analysis is interpretive, subjective, impressionistic and diagnostic (Creswell, 2013). This paradigm places the ideas and reasoning of participants at the core of the study and respects participants' thinking and views. It is an ideal paradigm because the competitive advantages, role and impact could only be understood by allowing industry leaders and their teams to give their own stories. Most ICT literature is not grounded in the experiences of leaders in the ICT industry. Interpretivism is not primarily concerned with explaining the causes of events, but with how phenomena are experienced at first-hand by participants (Denscombe, 2014). In addition, interpretivism is ideal because the competitiveness of South Africa's ICT industry had not previously been fully explored. This philosophy is particularly appropriate for addressing the "how" question (Pratt, 2009), which is critical to a better understanding of the issues under study.

According to Roth and Mehta (2002) interpretive analysis of subjective meaning cannot withstand the scrutiny of empirical tests of validity across test cases because it is by nature tied to particular social systems. The construction of contributory laws

and patterns that are generalisable across cases also splits the interpretation from what has happened. Interpretive analysis is self-validating as it cannot be systematically theorized and assessed (Geertz, 1973). The legitimacy of the analysis can only be measured by how well the “thick description” holds up within the case and is supported by accompanying evidence.

Qualitative research ensures that the researcher has access to the many understandings of interviewees. In addition, data has thick description. Thick data descriptions are coherent and offer more than facts, interpreting information based on empirical data and contextual theories (Guba & Lincoln, 1994). Interpretation of qualitative data can be enhanced from understanding to explanation. However, qualitative research is considered subjective and difficult to replicate. The research process affects reality. Facts and values are not distinct and objective: value-free research is impossible (Ritchie et al., 2013).

3.3. Stage 2 – Research approach

The approach adopted for this study is inductive as the research is qualitative and there is limited material available on the topic. Research starts from questions posed to observations, progressing to description, analysis and finally to theory. Research is not testing a hypothesis. As such, the research approach is inductive.

3.4. Stage 3 – Research strategy

The research strategy adopted for this qualitative study is grounded theory. Grounded theory was chosen after studying its basic tenets.

3.4.1. Grounded theory

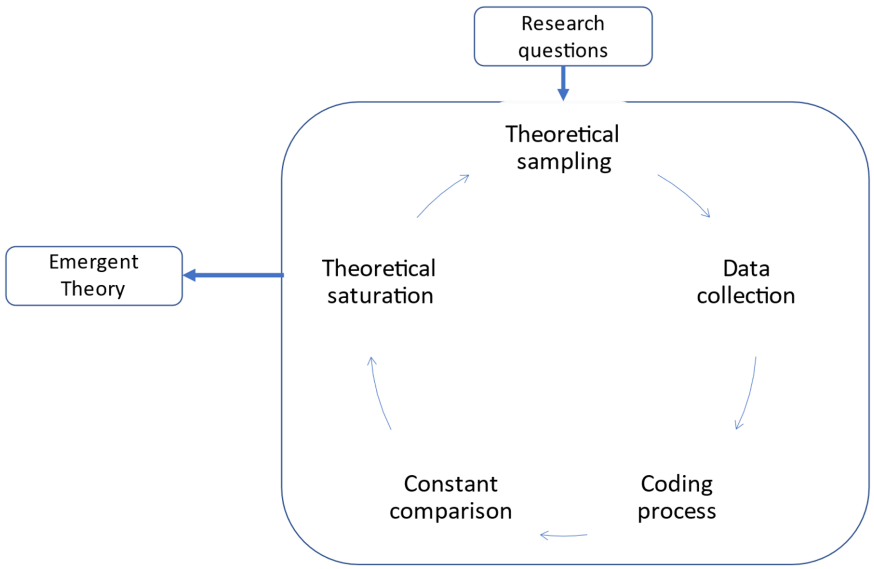
Grounded theory is a general methodology for developing theory that is grounded on data systematically developed and analysed (Strauss & Corbin, 1994). A literature review may be conducted before starting a grounded theory study (Myers, 2013). However the researcher must avoid having pre-conceived ideas about what may be

found during the research process (Denscombe, 2014). Grounded theory methods involve a logically consistent set of data collection and analytic procedures to develop theory (Charmaz & Smith, 2003).

3.4.2. Why grounded theory

In this research, basic theory is resource-based theory. It is further developed by determining strategically valuable resources (SVRs) to develop the global competitiveness of South Africa's ICT industry, building on the data systematically developed and analysed. During this process, strategically valuable resources (SVRs) are determined, and resource-based theory is developed by comparing ideas with initial data and improving the theory against the new data collected during the interview process as shown below in Figure 14. The study does not involve testing a hypothesis. The researcher starts out with an open mind. This is practical as the interviewees are executives or decision makers who will benefit from the research. The study meets the basic tenets of grounded theory and grounded theory is the most suitable research strategy.

Figure 13: Grounded theory in application



Source: Author's construction

3.5. Stage 4 – Research choices

The research choice is mono-method, involving only one method for the study. Only the qualitative method is used, as explained above in the research philosophy described in section 3.2.

3.6. Stage 5 – Research time horizons

The research time horizon is cross-sectional. A cross-sectional time horizon involves a snapshot view of the situation at a single point in time: for instance, interviews are held in 2020 in the month of September.

3.6.1. Research Design

Mouton (1996) likens research design to a route planner. The design provides a set of guidelines and instructions to reach the research goal. According to Mouton (1996) formulating the research problem involves two important tasks. The first is specifying "the what" of the study and the second is specifying "the why" of the study.

The research design is cross-sectional as it will be based on in-depth interviews probing the competitiveness of South Africa's ICT industry at a single point in time. Interviews will be with executives and senior managers in the following sectors: telecommunications, banking, the South African high-technology sector and MNCs in South African ICT.

These sectors are chosen for the following reasons:

Firstly, telecommunications is the largest and most successful sector in the ICT industry. Its contribution is essential. In addition, this sector is likely to benefit from the research. Secondly, financial institutions are the biggest users and developers of ICT. Currently, most financial institutions have outsourced their ICT to MNCs. As such they have a good understanding of these MNCs, strategically valuable resources (SVRs), and the competitiveness of the MNCs. In addition, they may understand the deficiencies of South Africa's ICT industry. Thirdly, there is the high-technology sector,

which consists of technologies such as aerospace, oil from coal and the arms industry. The high-technology sector may have knowledge of the strategically valuable resources (SVRs) required to enable South Africa's ICT industry to be competitive. Finally, there are the multinationals in South Africa. These are the main international competitors of the South African ICT industry. Their representatives may have knowledge of the competitiveness in the global ICT industry. In addition due to their experience in South Africa, they may have knowledge of the competitiveness of South African ICT industry.

Participants have either worked for, or are working in, the organizations listed below or in similar organisations**.**

Table 1: Organisations

Name of the company	Sector	Participant
Company A	SA telecommunications	ICT executive
Company B	SA telecommunications	ICT executive
Company C	SA telecommunications	ICT executive
Company D	SA telecommunications	ICT executive
Company E	SA high technology	Executive
Company F	SA banking	ICT executive
Company G	SA banking	ICT executive
Company H	US ICT multinational	Executive
Company I	US ICT multinational	Executive
Company J	US ICT multinational	Executive
Company K	Chinese MNC in South African ICT	Executive

Name of the company	Sector	Participant
Company L	Indian MNC in South African ICT	Executive
Company M	US MNC in South African ICT	Executive

Source: Author's construction.

Interviews will focus on collecting information on interviewees' views of the competitiveness of the South African ICT industry. Among them will be executives of banks that are major clients of ICT multinationals involved in the South African ICT industry, including managed services.

The interviewees' organisations are in South Africa and have various levels of US, Chinese, Indian and South African state participation and ownership. The companies cover the entire South African ICT spectrum. Interviews will be conducted locally.

3.7. Research Onion summary

Table 2: Research Onion

Elements	Description
Philosophical science (Layer 1 in Research Onion)	Interpretivism
Research approach (Layer 2)	Inductive
Research strategy (Layer 3)	Grounded theory

Elements	Description
Theorising (Layer 4) Choices in Research Onion	Mono-method, only qualitative
Time horizons (Layer 5)	Cross-sectional. At a single point in time.
Researcher role	Iterative discussions with the participant. Encourage participant to speak freely on the topics and develop themes. Baseline of questions in Appendix A used to develop further insights and further questions.

Source: Author's construction.

3.8. Stage 6 – Techniques and procedures

The techniques and procedures relate to data collection and analysis.

3.8.1. Population

The research population encompasses relevant strategic ICT decision makers of multinational and South African private sector and parastatal organisations. Strategic ICT decision makers are executives or senior managers.

3.8.2. Sample and sampling method

The sampling method is theoretical sampling. For this reason, experts in areas of the South African ICT industry such as telecommunications, high technology and IT are selected. In addition, experts from ICT multinationals in South Africa and from financial institutions are included. Financial institutions are major users of ICT in the country. This process is different from sampling in quantitative research where individuals are chosen because either they are representative of a population, or they are available. It is important to select individuals who understand the main problem, have sufficient

experience (at least 20 years) and are leaders in the South African ICT industry. This will allow the researcher to achieve theoretical saturation within a reasonable time.

Four expert samples will be included. Selection of the sampling set is based on suitability and availability.

The interviewing method will involve a series of semi-structured in-depth interviews, using open-ended questions. In semi-structured interviewing, data can be analysed by several methods of data analysis (Willig, 2013). An initial set of questions is prepared in the interview protocol for the interviews. Further probing questions evolve during the interview or in follow-up interviews in line with grounded theory. These questions will elucidate detailed answers. Thematic and direct content analysis will be undertaken with the use of ATLAS.ti software.

3.8.3. Type of data collection

The type of data collection used is interviewing. Interviews will be primarily remote as a result of the Covid-19 pandemic. Interviews will take place in South Africa.

Creswell (2013) believes interviews are advantageous as they give the researcher control over the line of questioning. Furthermore, they allow questioning over a long period of time, encourage open exchanges, and are both cost- and time-effective. In addition, participants can provide historical information. However, Creswell (2015) believes there are limitations to interviews. These limitations are that the interviews provide limited information filtered through the lenses of participants. Furthermore, participants may not be sufficiently articulate to express their views and perspectives.

The main criterion for choosing interviewees is that they possess important information for the purpose of the research (Mays & Pope, 1995). In this case, participants should have a minimum of 15 years of experience in the ICT field at a senior management level. Potential participants will be first approached informally to obtain their contact details. They will then be formally approached via email. Participant information sheets, informed consent forms and a summary of the research study (including

definitions of terms) will be provided. Company policy regarding permission for remote interviews will be ascertained.

Once participants confirm their availability, interview sessions will be set up. Interviews will be semi-structured and as such there will be multiple sessions over a period of two months.

3.8.4. Ethical and study procedures

Ethical and study procedures involve firstly obtaining informed consent, secondly minimising the risk of harm to the participants, thirdly protecting anonymity and confidentiality, and finally ensuring that participation is voluntary.

The informed consent form and participation information sheet address the four procedures.

The participation information sheet notifies participants of the steps taken by the researcher to obtain informed consent from a participant, minimise risks and protect the anonymity and confidentiality of participants. Finally it explains to participants that their involvement is voluntary.

Both the participation information sheet and the informed consent form are part of the Interview Protocol.

A participant information sheet is attached as Appendix A.a.

An informed consent form is attached as Appendix A.b.

The ethics clearance sheet is attached as Appendix B.

3.8.5. Semi-structured interviews

Semi-structured interviews will be utilised for relevant data collection. In a semi-structured interview an open-ended and flexible interview protocol is used to allow participants to speak openly and develop ideas on the issues raised in the research (Denscombe, 2014). An interview protocol is used as a baseline to cover all important

issues consistently with all participants. There are two main considerations for using semi-structured interviews (Barriball & While, 1994). Firstly, they are most suitable for the exploration of perceptions and opinions of participants on complex issues and allow probing for more information and clarification. Secondly, they are valuable when a standardized interview schedule is not possible because of the diverse professional or historical backgrounds of participants.

3.8.6. Why semi-structured interviews?

The South African ICT industry is a diverse field. Multinationals in the South African ICT industry present a diverse field. Participants therefore come from different backgrounds, and it will not be possible to use a standardised interview schedule. Secondly, the ICT industry is complex. In line with the research strategy, which is grounded theory, it is imperative to seek participants' perceptions and opinions and allow for probing to gather more information and clarification to develop theory by the constant comparative method.

3.8.7. Procedure for data collection

The procedure for data collection from the interviews is as follows:

Answers will be audio-recorded by the interviewer. Interview feedback will be logged in a separate document in the form of transcripts, which will be used as source material for the research's analysis and conclusions.

3.8.8. Research instruments

The research instrument will take the form of interview questions. Interview questions will be designed to focus on collecting participants' views of the competitiveness of the South African ICT industry,

An interview protocol is presented in Appendix A. An interview protocol may be further enhanced once the participant list is finalised.

3.8.9. Coding, data analysis and interpretation

Inductive coding is used as the researcher is approaching the interview process with an open mind and conducting exploratory and heuristic research on the South African ICT industry (Thomas, 2006). There is limited literature available on the South African ICT industry. At the same time, thematic analysis of the literature on ICT multinationals in South Africa allows the researcher to develop a prototype codebook. This codebook will evolve during the interview process and analysis.

The interview and questionnaire data will be analysed using content analysis. There are three approaches to content analysis (Hsieh & Shannon, 2005). A direct content analysis approach will be used as the study is developing an existing theory in the form of a resource-based view.

All results from the interviews will be interpreted in an unbiased and impartial manner in accordance with the basic tenets of grounded theory. Information obtained from the interviews will be analysed to link it to the research problem. Concepts and theories will be developed out of data through a stringent process of comparing ideas with existing data, while improving the emerging concepts and theories against the new data collected specifically for this purpose.

3.9. Limitations of research method

Potential limitations and weaknesses of the selected research method include:

- Participants may not disclose candidly their companies' capabilities, plans and activities in South Africa;
- Because of time constraints and important engagements, participants might have taken short cuts on various answers or explanations; and
- Participants may not be able to express their own views and instead follow corporate or government disclosure guidelines.

3.10. Managing the Limitations

Research limitations can impact the validity and reliability of research findings. In this study, some potential limitations and weaknesses have been identified, including the possibility that participants may not disclose candidly their companies' capabilities, plans and activities in South Africa, time constraints and important engagements leading to shortcuts in answers or explanations, and participants may not be able to express their own views and instead follow corporate or government disclosure guidelines. To manage or minimize the effect of these limitations, the following approaches was used:

I. Participants' unwillingness to disclose candidly:

Here the researcher provide participants with assurances of confidentiality and anonymity to encourage honest and open responses. Also, the researcher made use of indirect questioning techniques, such as hypothetical scenarios or case studies, to gather information without directly asking for sensitive information and finally, the researcher build rapport with some of the participants to establish trust and encourage candid responses.

II. Time constraints and important engagements:

In other to manage the limitation that came about as a result of the time constraints, the researcher designed a Gantt chart that helped him to plan ahead and schedule interviews or data collection sessions well in advance to accommodate participants' schedules. Also, the researcher tried as much as it could be possible to work around participants' availability, including offering the option for remote interviews or surveys. Finally, the researcher provided clear and concise instructions to participants to minimize the time required for data collection.

III. Participants following corporate or government disclosure guidelines:

In other to make the target participants or institution to be open to respond to questions that bother on corporate or government disclosure guidelines, the researcher ensured to provide clear assurances of confidentiality and anonymity to encourage honest and

open responses. More so, the researcher also made use of multiple data sources, such as public records or secondary sources, to triangulate information gathered from participants.

3.11. Trustworthiness

Amankwaa (2016) states that research without rigour has either little value or no value at all. According to Golafshani (2003) reliability and validity are conceptualised in qualitative research as trustworthiness, rigour and quality. According to Shenton (2004) many critics are reluctant to accept the trustworthiness of qualitative research. However Guba's constructs go long way in satisfying their questions. Shenton (2004) proposes four criteria, these being transferability, credibility, dependability and confirmability.

According to Greenhalgh and Taylor (1997) the strength of qualitative research lies in its validity. This is because with good qualitative research using a selection of data collection methods, a researcher will be able to get to the core of the problem rather than being left with just a superficial view.

3.11.1. Transferability

Transferability refers to the need for sufficient detail of the context being provided to readers to enable them to decide whether the environment in question is similar to another environment and the findings can be applied to this similar environment (Shenton, 2004). In quantitative research, transferability is also known as external validity.

External validity refers to the ability to generalize from the study to a larger population (Bryman, 2012).

Since the interviews were conducted with several participants who were not randomly selected, generalization will not be appropriate. On the other hand, the findings and insights gained in this research may be of value to South African policymakers and

business entities already engaged with Indian MNCs or in the process of engaging with Indian multinationals.

In terms of transferability, this research will focus on obtaining thick description. Thick description allows the researcher to present a detailed account of interview experiences while making explicit the patterns of cultural and social relationships and putting them in context (Holloway, 1997). Detailed quotes from participants are provided in order to obtain thick description.

3.11.2. Credibility

Credibility means that the researcher is attempting to present a true picture of the phenomenon being researched (Shenton, 2004). In quantitative research, credibility is known as internal validity.

Internal validity is defined as drawing suitable or fitting deductions from the information generated from an interview (Kalof, Dan, & Dietz, 2008). Internal validity in this study will be maximised as the questions will be specific. There will be little uncertainty regarding the information required from participants and thus there should be no possibility of misinterpretation.

Credibility of research findings is enhanced by participant validation (Bryman, 2012). Participants will be requested to confirm the conclusions reached from their transcripts.

3.11.3. Dependability

In quantitative research, dependability is known as reliability.

Raw data will be collected during the qualitative process with thick description, such as transcripts of interviews and audio recordings. It is important to keep accurate records of the interviews (Mays & Pope, 1995). One of the primary reasons for taping the interviews is that data can be analysed independently at a later stage.

The wide range of participants to be interviewed guarantees that a representative sample of the overall population will be examined. All participants will be interviewed using a standardised questionnaire to ensure reliability.

3.12. Conclusion

This chapter presented the research strategy that will be employed to extrapolate and analyse the data relating to the capabilities required to develop the competitiveness of the South African ICT industry and ICT firms. The research design was described, as were the procedures for data collection, the research instrument, data analysis and the interpretation approach. Also covered were possible limitations and the trustworthiness of the process.

The interview protocol and research timeline are provided in the appendices.

In the next chapter, information about participants, thematic content analysis and discussions on the competitiveness of the South African ICT industry are presented.

Chapter 4: Competitive status

4.1. Introduction

This chapter consist of three sections. The first section focuses on the participants who were interviewed. It provides information about the participants, their experience in the ICT industry and their current positions. The second section focuses on thematic content analysis of the interviews. It provides the coding report obtained using ATLAS.ti software and themes. The final section involves a discussion on the current competitive status of the South African ICT industry with the focus on the research question related to competitiveness. Lengthy quotations from participants are provided as they offer a rationale for their responses and constitute thick description of the data. Thick description of data provides detailed accounts of interview experiences in which the researcher makes explicit the patterns of cultural and social relationships and places them in context (Holloway, 1997).

The primary research question is:

What are the strategically valuable resources (SVRs) required by South African ICT companies to develop the global competitiveness of the South African ICT?

Secondary questions are:

- What is the current competitive status of the South African ICT industry?
- What are the current strategically valuable resources (SVRs) of the South African ICT industry?
- What are the current strategically valuable resources (SVRs) of the ICT multinationals that are competing with the South African ICT industry?

The final section in this chapter addresses the following secondary question:

- What is the current competitive status of the South African ICT industry?

The primary research question and the remaining secondary research questions are addressed in Chapter 5.

This study determines the competitiveness of the South African ICT sector compared to ICT multinationals operating in South Africa. It also determines the strategically valuable resources (SVRs) required to develop the competitiveness of South African ICT firms. From interviewing high-level and experienced ICT executives and senior managers, the study obtained valuable insights and an insider view of the competitiveness of the South African ICT industry.

4.2. Participants

Fourteen participants were interviewed using the Zoom video conferencing application. Interviews were conducted until theoretical saturation was achieved as per grounded theory. Because of the limitations imposed by the Covid-19 pandemic and issues of availability, a few of the originally proposed participants could not be interviewed. Alternative participants from similar organisations or with similar experience were interviewed.

Participants have experience of working in more than one ICT organization. This is necessary to ascertain different experiences and knowledge in different ICT fields and sectors.

Table 3: Participants

Participant	Position	ICT experience	Type of organisation
1	CEO, previously exec.	20 years	South African ICT development SME
2	ICT programme exec, previously senior manager.	20 years	SA bank
3	Executive director South Africa. Previously CIO.	25 years	US ICT multinational
4	ICT exec	20 years	SA telecommunications
5	ICT exec, experience with US multinationals. Previously CIO.	26 years	US ICT advisor/partner
6	ICT exec	20 years	SA telecommunications
7	Head, customer delivery and innovation.	26 years	SA bank
8	ICT exec	25 years	SA telecommunications
9	ICT exec	25 years	SA telecommunications
10	ICT exec	25 years	SA telecommunications
11	ICT exec	25 years	SA telecommunications

Participant	Position	ICT experience	Type of organisation
12	Senior manager –mining, digital and data analytics	20 years	SA high technology
13	Senior manager	20 years	Indian multinational
14	Senior manager	20 years	Chinese multinational

Source: Author's construction.

All the participants from South African companies have experience in working with multinationals. All have more than 20 years' experience in the ICT industry.

4.3. Thematic content analysis

Thematic analysis is a method of systematically identifying, collating and providing insights into a pattern of themes across a data set (Braun & Clarke, 2012). Two main reasons for using thematic analysis are accessibility and flexibility.

4.3.1. Familiarisation

Familiarisation refers to the process during which the researcher becomes apprised of the transcripts of data collected and gains an overview of the collected data (Ritchie & Spencer, 2002). In other words, the researcher becomes engrossed in the data by listening to audiotapes and reading the transcripts. Throughout this process the researcher will become aware of key ideas and recurrent themes and make notes of them (Srivastava & Thomson, 2009).

4.3.2. Theoretical sampling and theoretical saturation

From the literature review, initial coding was undertaken for the strategically valuable resources (SVRs) of the multinationals being considered here. Data was analysed as soon as it had been collected from the recording of interviews. The recording of the first interview was analysed, preliminary coding was done, and additional probing questions were developed, subscribing to theoretical sampling in accordance with grounded theory. The first participant has worked in multiple ICT companies in the South African ICT industry and numerous ICT multinationals. The interview with the first participant gave rise to additional probing questions. An iterative process was continued until theoretical saturation was achieved with the 14th participant.

Theoretical sampling and theoretical saturation are central to grounded theory (Sbaraini et al., 2011).

All recordings were transcribed during the process and loaded into ATLAS.ti software for familiarisation purposes.

4.3.3. Coding and comparing

Coding is a process of breaking data down into much smaller components and labelling those components, comparing data with data, case with case, event with event and code with code, to understand and explain variations in the data. Codes are eventually combined and related to one another: at this stage they are more abstract, and are referred to as categories or concepts (Sbaraini et al., 2011). Initial codes were developed for multinationals from the literature review.

Table 4: Initial codes from the literature

ICT multinational	**Strategically valuable resources (SVRs) from literature**	**Initial codes**
Huawei, ZTE	Research and development, capital financing. Quality, cost factor, work ethics, technological innovation, knowledge sharing, supply chain.	MN research and development, MN financing, MN technology, MN quality. MN, government policies, MN China, MN work ethics, MN teamwork, MN supply chain, MN cost-effectiveness.
TCS	Software development, work ethics, technological innovation, higher value-added services, research and development, management style, planned opportunism and cost factor, knowledge sharing.	MN, India, MN work ethics, MN technology, MN research and development, MN management, MN teamwork, MN cost-effectiveness, MN software development.
Intel	Platform leadership, architecture leadership. Pool of research facilities around the world.	MN technology, MN research and development, MN brand.
Cisco	Platform leadership, network standards leadership.	MN technology, MN brand.
Apple	Innovation, products.	MN innovation, MN product, MN brand.
IBM	High-end hardware.	MN equipment.

ICT multinational	Strategically valuable resources (SVRs) from literature	Initial codes
Ericsson	Product diversification. Adoption of emerging technology (cloud computing).	MN product, MN cloud monitoring.

Source: Author's construction.

From the data set, codes were generated that identified important features relevant to answering research questions. The entire data set was coded. In total 190 codes were generated. Each code has its own data extracts. Codes and their data extracts were then collated into code groups. Thirteen code groups were created.

Codes and code groups were developed from the data set using ATLAS.ti software in alignment with the research questions. A code may be in more than one code group.

The final coding report is attached in Appendix B.

4.3.4. Themes

Themes are related to research questions and were developed from the code groups.

Table 5: Themes and research questions

Theme	Theme	Research questions
1	Current competitiveness of South African ICT industry	Secondary research question 2
2	Competitiveness of multinational ICT industry	Secondary research question 2

Theme	Theme	Research questions
3	Current strategically valuable resources (SVRs) of South African ICT industry	Secondary research question 1
4	Strategically valuable resources (SVRs) of Multinational ICT industry	Secondary research question 3
5	Required strategically valuable resources (SVRs) of South African ICT industry	Primary research question

Source: Author's construction.

Table 6 below provides the one-to-many mapping of the themes to code groups.

Table 6: Themes and code groups

Theme	Theme	Code groups
1	Current competitiveness of South African ICT industry	1. SA competitive in some sectors 2. SA historic competitiveness 3. SA why not production-competitive 4. SA service-competitive 5. SA education 6. SA training 7. SA Government policies
2	Competitiveness of multinational ICT industry	1. MN competitiveness 2. MN knowledge 3. MN government policies

3	Current strategically valuable resources (SVRs) of South African ICT industry	1. SA current strategically valuable resources (SVRs)
4	Strategically valuable resources (SVRs) of multinational ICT industry	1. MN strategically valuable resources (SVRs)
5	Required strategically valuable resources (SVRs) of South African ICT industry	1. SA-required strategically valuable resources (SVRs) 2. SA Government policies 3. SA training 4. SA education

Source: Author's construction.

4.4. Competitiveness of South African ICT industry

- What is the current competitive status of the South African ICT industry?

4.4.1. Competitiveness of South African ICT industry

There is a consensus that overall, the South African ICT industry is competitive only in some ICT sectors.

> *I mean you really need to look at what aspects, or what you refer to as the ICT industry, because it spans such a broad area, right. I would also say that in some areas, I believe it's quite competitive.* (Participant 5 – 4.1)

> *I think we are competitive in some areas, there are certain areas that industries are strong.* (Participant 7 – 10.1)

This is primarily in the ICT service sector and specifically in mobile services, broadcasting, financial services, cyber security, management of suppliers, quality of service and system integration.

> *…but the services themselves are actually very competitive.* (Participant 4 – 3.7)

Competitiveness of the ICT services sector extends to banks.

> *…if I look at ICT players, say look at the service provider's side, i.e. system integrators, who do manage services and software delivery services for the banks.* (Participant 5 – 4.4)

There is consensus that mobile services have become the primary solution for many other services, for instance the banking sector using mobile applications for financial services. Examples of competitive mobile services are MTN and Vodacom. In the broadcasting sector MultiChoice is an example which uses both satellite and telecommunication services.

> *…broadcasting and telecommunications, definitely good.* (Participant 10 – 7.3)

> *I do believe that we are competitive in certain areas, especially in telecommunications coming from – and I think we're competitive in the telecommunications sector, in world terms – in the global context*. (Participant 10 – 7.6)

Competitiveness in the ICT service sector extends to health services providers such as Discovery which have innovative ICT solutions.

> *Standard Bank, like Discovery, MTN, Vodacom, even MultiChoice for that matter.* (Participant 2 – 6.37)

There is a consensus that mobile services are a strategically valuable resource for the South African ICT industry. Competitiveness in the service sector is brought about by innovations offered by, for example, mobile services.

Current strategically valuable resources (SVRs) in the South African ICT industry are discussed separately in Chapter 5.

There is also consensus that the South African banking sector has evolved into financial technology service (FinTech), which is an ICT service. Banks have started using competitive technologies. Examples are First National Bank and Standard Bank, which have become Mobile Virtual Network Operators (MVNOs). As such, they are both in the banking and the mobile services spaces.

> *Maybe let's take an example of the financial industry where our financial industry was providing a lot of competitive technologies in the FinTech space compared to other countries.* (Participant 7 – 10.3)

In addition, banks are actively participating in the 4IR by using artificial intelligence, big data, Blockchain, automation, etc. Banks also offer emerging technologies in FinTech services such as electronic wallets.

Although the consensus is that South Africa is not competitive in ICT development, one participant feels that in software development, some companies within South Africa are competitive.

> *…and development, I would say, general development.* (Participant 9 – 11.35)

Other participants believe South Africa is competitive in information security, specifically in cyber security.

> *So, in terms of maturity as a security industry, I do believe we are competitive in South Africa – in the South African context.* (Participant 10 – 7.16)

One participant alluded to the competitiveness in the South African ICT services sector in relation to specialisation.

> *So, as I said, yes there are specific areas which they would have an edge over the multinationals, because the multinationals cannot specialize in as much as the local guys can.* (Participant 12 – 12.16)

Only one participant believes the South African ICT industry is competitive overall.

> *…my opinion is we are competitive as the industry is very broad.* (Participant 4 – 3.1)

On the other hand, a participant asserts that the South African ICT industry is not competitive in any ICT sector.

> *…having had exposure to the world – service and support and vendors throughout the world, I don't believe that South African ICT organisations are competitive.* (Participant 10 – 7.10)

One of the participants who stated that the South African ICT industry is competitive only in the ICT service sector also asserted that it does not really matter if the industry is mainly service-competitive. The same participant believes South Africa must focus on the ICT service sector.

According to the same participant there is a valid reason to focus on the service effort as it brings in 80 percent of the value in the South African ICT industry.

> *It's an 80/20 for me. I would like to believe that if we focus 20 percent of our efforts in services.* (Participant 4 – 3.61)

Participants also point out that the South African ICT service sector still depends to an extent on external input for hardware and software development. However, financial services such as banking and insurance utilise South African ICT companies for ICT development and support.

All the participants agree the South African ICT manufacturing and ICT development sectors are not generally competitive when compared to multinationals operating in the South African ICT industry.

Participants also believe the South African ICT industry was historically competitive. They link this to the international sanctions that were applied during the apartheid era and the resultant government funding and abundant niche skills. Niche skills – specifically in engineering – were developed in state-owned enterprises such as Denel, Telkom, Sasol, Transnet and others. These were also specialist skills. The relationship between academia and industry was coordinated and managed by the state to make use of the intellectual property in the academic world.

> *You know, these are probably companies that are better placed to go forward. So, we can use Sasol and Denel, but the companies of the future to me are more along the lines of the ones I mentioned*. (Participant 2 – 6.38)

Participants also believe the historical competitiveness of the South African ICT industry is still evident today. Current competitive ICT service sectors in South Africa such as the mobile sector (Vodacom) grew out of Telkom, which was historically a highly competitive operator. Similarly, MultiChoice grew out of the SABC, which was historically competitive.

Participants emphasised the abundance of niche skills during the apartheid period, resulting from government resistance to sanctions,

> *…it was the apartheid era where you couldn't really source anything overseas, so whatever, you know, was needed and that's mainly because of the sanctions and so on.* (Participant 11 – 8.4)

> *…these guys bore up these skills from the 1980s/1990s when we didn't have the multinationals available in the country.* (Participant 12 – 12.10)

Participants also highlight the role of niche skills in innovation during the apartheid era in detail.

> *If I had to look at maybe in general in the Telco sector I would say 30 years ago South Africa were – leaders because every innovation that happened in the country was sort of developed by South African engineers and pioneered here and deployed in South Africa.* (Participant 11 – 8.3)

> *…niche skills, for example, Denel.* (Participant 8 – 9.41)

However, participants also point out that the companies that were successful during apartheid days have now lost their competitiveness.

> *When it comes to companies like Denel and Sasol, I do think that they've sort of lost their competitiveness, especially Sasol – I mean, Sasol is taking a beating now in strategic prices globally.* (Participant 2 – 6.3)

In the ICT manufacturing and development sectors, the South African ICT industry is not competitive and lags behind the multinationals. During the apartheid era the South African ICT manufacturing sector was competitive in an effort to resist sanctions. Sanctions created a requirement to manufacture locally. In addition, the South African ICT manufacturing sector was supported by government policies and funding. However, since 1994 government support has been reduced, and some funding comes from the private sector. On the other hand, multinationals gain as China and India in particular provide government support and funding for their ICT manufacturing sectors.

South African ICT niche skills are also depleted as a result of talent moving overseas.

> *…but losing the edge because of the skills-set drain that the country is experiencing and in other areas, I think it's not very competitive again, because of a lack of skill set in those areas.* (Participant 5 – 4.2)

South African engineers are highly in demand overseas because of their quality. Engineers gain valuable experience and skills at a very early stage in South Africa when they finish their studies and employed as junior engineers.

> *…definitely the pool of engineers, if they're put correctly – and you can see from the – you know any stats of people that are leaving the country – I mean, it's very easy for South African engineers to get jobs overseas because the quality of our engineers especially – and even the computer science engineers are very good.* (Participant 11 – 8.53)

Participants also feel the current education system is not conducive to producing creativity and innovation. As a result, the education system is also not assisting South Africa to become competitive in ICT manufacturing or ICT development.

> *South Africa would be a world leader, but it's just that lacking – it's also – it's skills education, and what I saw in those countries that skills and education was great there, or was better.* (Participant 10 – 7.46)

Participants felt that the Education system is not enabling skills to enter ICT.

> *Generally, those are the skills that you need to enter the technical space, and when I say technical space, which covers the majority of ICT. So, for me there's a grassroots problem South Africa faces, in that we've got an education system that we can't really, you know, rely on – I'm not saying that it's a complete failure.* (Participant 9 – 11.32)

Higher education produces computer science graduates who are doing ground-level programming or providing support in the industry, instead of being creative and innovative. In addition, they are expensive.

> *So, in South Africa unfortunately, skills are not available and if you do find the skills to support some of the staff, they are not necessarily cheap.* (Participant 12 – 12.15)

Several participants suggested coding schools could train matric students to be ground-level programmers. This would address the cost of skilled staff.

Globalisation has offered opportunities to multinationals to offer products that are cost-effective and of good quality. Some participants feel South Africa is not globally competitive.

Another issue of major concern is the lack of coordination between academic research and industry. Some participants feel that research, even at PhD level, cannot be commercialised by industry, while intellectual property is just sitting in the academic world or being exported to other countries for foreign exchange.

> *You'll actually find a lot of overseas organisations partner with our universities to get access to the research that happens because of the patents* (Participant 11 – 8.59)

Participants deplore the lack of cooperation between academic institutions and industry in leveraging the intellectual property sitting in these academic institutions.

Participants also singled out difficulties such as collaboration.

> *And that's often a big challenge between the industry; when we have these collaboration sessions between, let's say, industry and institutions – educational institutions – we always – because we operate at almost very different levels – at a very, let's say business level versus a granular technical level, it's very difficult, and we often see clashes in terms of what research we expect, this is what is done from universities' side*. (Participant 11 – 8.62)

Participants feel government should take a proactive role in coordinating academic institutions and industry.

However, some participants feel there is a certain amount of partnership between the private sector and the academic world.

> *Well, I think there is some relationship between the private sector and the universities and government. There is some relationship. But we also have in South Africa that relationship is highly strained. It is highly strained*. (Participant 12 – 12.44)

In a nutshell, participants emphasise the need to leverage the local intellectual property that is available in the academic world.

> *But maybe we need to relook at how you incentivise the ICT industry to take advantage of the IP that's sitting on the shelf. That could be something that could benefit both parties.* (Participant 9 – 11.45)

On the question of training, participants note that companies consider internal training to be an operational expenditure rather than a capital expenditure. Investors expect short-term returns from investment as opposed to long-term returns.

However, there are exceptions. Some ICT companies consider training to be a capital expenditure.

> *…but again, companies like Dimension Data also spend an insane amount of time not just with management training, soft skills training, but also technical training, and linking them up into global ecosystems. I mean the quality of courses you can get from globally recognised universities is just insane at the moment.* (Participant 5 – 4.49)

South African data strategy is considered a barrier for entrepreneurs. Network coverage is insufficiently widespread to benefit entrepreneurs. In addition, government indecision about allocating spectrum hampers the rolling out of more coverage. Data costs, as compared to the costs in China and India, are another impediment.

> *But where my domestic stays, she still doesn't have coverage but should we not also make the right decisions about the access? There's areas, and I'm thinking of the non-urban areas, we don't have data as soon as you go out of Joburg, Cape Town, Durban. You know, even where you go down to the Garden Route to the Eastern Cape, there's no data. You will be lucky if you have good 4 or 4LTE, you know.* (Participant 1 – 1.57)

The government is criticised for being lacklustre about the issues of network coverage and spectrum. Targets for broadband coverage are constantly moving.

NDP 2020, now NDP 2025, now it's ending in 2030 – you know, you wanted 80 percent broadband coverage or 90 percent – I can't remember the exact statistic. (Participant 9 – 11.62)

Participants felt government focussed only on extracting revenue from the mobile sector.

…our stance at government policy seems to be, let's milk the cow. Instead of using it as an asset to develop our sectors, government uses it as a revenue source and this is one of the reasons to me that our – the bandwidth costs are so high – is because the government controls the spectrum. (Participant 2 – 6.63)

Participants think start-ups are not really materialising as it difficult to get many local resources.

But in start-up technologies you don't get many human resources locally. (Participant 2 – 6.11)

Participants also deplore the dependence on international intellectual property and its cost to the economy.

…but we obviously rely on a lot of international IP when it goes to software development, when it goes to licences of the things we use; we obviously use a lot of things that are licensed in the US like Microsoft, like the 3GPP stack the telecom companies use. You hardly find that the IP goes into the services and the licences are actually locally owned. (Participant 4 – 3.6)

You know, those types of things, those are the types of things we should have been able to take and develop further, but because these companies don't have R&D divisions. There is no mechanism to say there's the IP that we've paid for, we're going to now take it. So what companies tend to do, they will take that IP, lock it in a safe and say nobody else can touch it. (Participant 7 –10.39)

Participants believe the cost factor is detrimental to competitiveness in the South African ICT manufacturing and development sectors.

Our cost rates are actually very high. (Participant 1 – 1.32)

We have got people in South Africa, it's just that they're very expensive. (Participant 11 – 8.30)

Participants also felt that from cost point of view there is no reason to invest in South Africa.

People will really need a very good excuse to do something in South Africa, when they can do it at a fraction of the cost in India or in China. (Participant 4 – 3.29)

Participants propose institutions such as coding schools to produce low-cost programmers to compete with Chinese or Indian programmers. At the same time, this would also address unemployment among high school graduates.

That could be an avenue which – and cost-factor also could play a role, because if you have those that are coming out of the coding schools, they could be – compete even with the Indian programmers, or Chinese programmers at the lower level, right? (Participant 9 – 11.57)

Even in the services sector the equipment such as phones – although marketed as local products – is manufactured abroad.

They are, but you will find that most of the time, they may be manufactured specifically for Vodacom in South Africa but we use a mixed bag of suppliers. Some could be sitting in China, others could be sitting in India and all these other places. (Participant 4 – 3.16)

One participant linked this to the lack of effort to manufacture devices locally.

…but we have not made it our core competence to say we will manufacture devices locally in these factories. It's almost we have opened up the platform to say, "If you can manufacture according to 3GPP and you are compliant with ICASA and all that, we will use your device". (Participant 4 – 3.17)

All the participants state that multinationals operating in the South African ICT field are highly competitive. They have strategically valuable resources (SVRs). These SVRs are either related to a country or related to a particular company in a country. Participants opine that the SVRs for the multinationals which benefit their ICT competitiveness are cost-effectiveness, research and development, education, internal training, entrepreneurship, innovation, availability of international resources, skills, financing, knowledge pools, teamwork, balancing of costs and resources, long-term planning, and training being seen as capital expenditure. In addition, Western multinationals, plus China and India as countries, have their own country-based SVRs. Participants observe that China has a work attitude and customer-first attitude as country-based SVRs. Participants also assert that India has an integrated technical and functional (techno-functional) skill as an SVR. Chinese multinationals also have efficient supply chains.

Participants observe that multinationals have the advantage of being established and experienced companies with brands and thereby can persuade companies in South Africa to accept their offers. They have vast knowledge pools with global reach and hold patents and OEMs. They also utilise automation and artificial intelligence, together with centres of excellence. They bring new technologies. Multinationals – especially Chinese – focus on delivery and turnaround times. Indian multinationals offer fixed contracts to absorb delivery risks. Western multinationals manage costs by mixing expensive Western, or Western-based, team leaders with cheaper technical staff sourced from the developing world.

Finally, the study indicates multinationals have strategically valuable resources (SVRs) that in many cases are specific to the country. In addition, positive government policies, including support to entrepreneurs, play a major role in the competitiveness of multinationals. The SVRs of the multinationals are discussed in detail in Chapter 5.

Other rationales for the competitiveness of multinationals in the ICT manufacturing and software development sectors are suggested in the following comments by participants.

One reason is that multinationals are introducing fresh technologies.

Because they are bringing fresher technologies stacks, they don't have the legacy enterprise IT stacks that they also have to deal with. (Participant 5 – 4.16)

Another reason cited is knowledge-sharing. Knowledge-sharing takes place within multinationals and even among multinationals.

Again the thing that makes them highly competitive is the ability to do massive knowledge-sharing and collaboration internally and learning from one another what they're doing in other markets in how to be competitive, and yes, cost. Now, cost also depends on the markets you're playing in. (Participant 5 – 4.38)

Multinationals are also backed up by research and development in host countries.

Now if you take Neotel, [it] is backed by huge research and innovation and all aspects of it in India. (Participant 2 – 6.24)

South Africa is reliant on external technological platforms.

I do feel though most of the things that we are doing is not things that we have really developed in the country. I feel we are borrowing a lot, we are relying a lot in terms of the technological platforms that we use. (Participant 7 – 10.2)

The cost factor is again cited as another cause. Participants provided comparison of costs between South Africa and multinationals, specifically India and China.

Because the average junior developer in South Africa is paid way more than the average junior developer in India, in Thailand, you know, in Asia basically or in other parts of the world. (Participant 8 – 9.24)

I find that multinationals can be more cost-effective than South Africa. (Participant 1 – 1.29)

And what's happening now, because they can even support us from offshore, offshore resources are very cheap compared to our standard of developers in South Africa. The cost plays a very big role as well. (Participant 3 – 2.15)

Some participants express the opinion that South Africa may never be competitive in ICT manufacturing or ICT development.

> *…in terms of production, we are just not even close to being, not even world class. Production, meaning our ability to produce good technologies, we see the US and other Asian countries leading in terms of coming up with good technologies that can help us to have a better digital lifestyle.* (Participant 6 – 5.1)

> *I don't think we compete to the level of the multinationals that are in South Africa.* (Participant 3 – 2.1)

The following comments deal with Chinese multinationals in the ICT industry.

> *it's easier for Huawei too, so for that supply chain ecosystem to exist, China has put a lot of money in that I don't even think we can ever catch up, to make sure that companies exist within that eco-system to service other companies.* (Participant 6 – 5.15)

> *I think they've got the courage, they've got the risk appetite and they are looking at the long game like the Chinese, they are not looking at the short games.* (Participant 7 – 10.11)

ICT Multinationals from China and India are compared to South Africa.

> *There I think we are behind some of our, you know, Third World counterparts like the likes of ECS, Huawei, Huawei China and the other Chinese companies – similarly with the other Indian companies.* (Participant 10 – 7.3)

The role of foreign exchange in the cost factor is emphasised by participants.

> *It is currency exposure. So multinationals, when they come to South Africa, whether they are getting their resources from China, from India, they charge us in US dollars.* (Participant 8 – 9.37)

Many participants also believe Western multinationals have the best skills.

…but I think it's a country thing. It's like, those Europeans in Western Europe is what is considered, together with probably the Americans, that is where the skills is, the bright people are. (Participant 1 – 1.27)

So that would be my view of the competitiveness, it depends on who the customer, it also depends on what the product or the service required is, it changes the competitive landscape. But a big deal of it is still dominated by multinationals. (Participant 8 – 9.9)

Participants also comment on the competition for US multinationals from Chinese or Indian multinationals.

…because obviously, you know, the American technology sector is quite well-resourced, quite well-funded, quite well-developed. Now, the Chinese are coming in and in terms of resources the Indians also play quite a big role in providing human resources. (Participant 2 – 6.5)

Participants believe the biggest challenge for the South African ICT industry comes from multinationals operating here. They provided various reasons.

Now our biggest challenge for South African ICT industry comes from the multinationals, right, who are here operating. (Participant 9 – 11.5)

There unfortunately, the multinationals have got the edge, because they can bring the experience from international to South Africa. (Participant 12 – 12.65)

…but the things that's common with very competitive large-scale ICT multinationals are these things about collaborating and sharing ideas, seeing how they can leverage the learning from different markets to add value to their customers, bringing it in at fair pricing. (Participant 5 – 4.5)

Some participants feel South Africa has even fallen behind other African countries. Views of the participants are quoted below in detail to provide context.

And I think, for some reason I feel we have fallen a bit behind in terms of really being competitive and why I say that as a bit of a contradiction is if I look at

ourselves, South Africa and other developing countries like Kenya, I feel we have stagnated a bit. (Participant 7 – 10.4)

We should be leading the continent, but are we not going to be challenged by Kenya and Rwanda in the next few years? I am worried that haven't… We are still very much relying on traditional technologies of the past, we haven't embraced a lot of new ways that the other upcoming countries like Kenya or Rwanda in terms of really adopting leading edge technologies and taking risks in terms of supporting upstarts to do that. (Participant 7 – 10.5)

Participants explain how niche skills are appropriately utilised in multinationals originating from other countries.

I suspect when you go to countries like China, engineers are doing real engineer work. I know for a fact, I'm in certain classes with American students, they are doing real engineering work. When you talk about aerospace, you're talking about aerospace engineering, you're talking about manufacturing. Engineers are doing real engineering work. (Participant 7 – 10.44)

4.5. Conclusion

In this chapter, opinions relating to the competitiveness of ICT industry were presented and discussed. These findings address one of the secondary research questions, which is related to the competitiveness of the South African ICT industry. The remaining secondary research questions such as the current strategically valuable resources (SVRs) in the South African ICT industry and in multinationals are discussed in detail in Chapter 5. The issue of the SVRs required to make South Africa's ICT industry competitive overall is the primary research question and is discussed in Chapter 5.

This chapter makes a methodical contribution to the academic world as stated in the significance of the study (section 1.6.). One contribution is the thematic content analysis, including coding, applied to South African ICT and multinational ICT industries to produce findings related to their respective competitiveness. Another

contribution is the application of grounded theory in the methodology from data collection to data analysis. In this study, some SVRs of the multinationals were identified from existing literature through thematic analysis and pre-coded. The interviews conducted are semi-structured. Questions in the interview protocol were put to the first participant and codes and coding groups were further developed in accordance with theoretical sampling. Other participants are then given targeted questions based on pre-determined codes. Additional codes are developed when participants provide new data. The entire process is iterative, in accordance with grounded theory strategy, until theoretical saturation is reached.

Other findings are related to the historical South African ICT industry. It was found that historically, the ICT industry was competitive across all sectors. This was mainly caused by international sanctions having been applied during the apartheid era, as a result of which government support was provided to local industry in the form of funding and policies. However, since the end of apartheid, government support and funding has been dwindling. In addition, South Africa has lost niche skills developed during apartheid as a result of the brain drain.

Finally, South Africa has become competitive only in the ICT service sector, such as mobile, broadcasting and banking services, and information security. Historically competitive service sectors such as Telkom and the SABC have morphed into Vodacom, MTN and MultiChoice. Similarly, historically competitive South African ICT service sectors such as banking has transformed into FinTech services and remained competitive.

The South African ICT industry is competitive in the country's ICT service sector. However, on the negative side, the local ICT service sector depends on multinationals for manufactured items or software development.

Chapter 5: Strategically valuable resources (SVRs)

5.1. Introduction

Strategically valuable resources (SVRs) are discussed in this chapter, with the focus on the primary research question (Research Question 1), while secondary research questions related to SVRs are also addressed.

The primary research question is:

What are the strategically valuable resources (SVRs) required by South African ICT companies to develop the global competitiveness of the South African ICT?

Secondary questions are:

- What are the current strategically valuable resources (SVRs) of the South African ICT industry?
- What are the current strategically valuable resources (SVRs) of the ICT multinationals that are competing with the South African ICT industry?

5.2. Current strategically valuable resources (SVRs)

In this section, current strategically valuable resources (SVRs) that specifically make the South African ICT service sector competitive are determined.

Delivery is seen by participants as being a current SVR. Project management in delivery of projects is an SVR. System Integration is another SVR.

> *So South Africa, we're very good in driving delivery. Hence you see our project managers growing to go and work in the other countries, but from a leadership perspective, we are good with working with people in South Africa, because we are sensitive, we are high in IQ as a country.* (Participant 3 – 2.30)

> *We've got also, as private industry, we've also got to take things by the horns and try and get it developed.* (Participant 2 – 6.58)

Local knowledge and in-house capabilities are also seen as being strategically valuable resources (SVRs).

> *I think maybe with banks and other sectors it's a bit more because you know, they need that local knowledge and the local in-house capabilities, rather than having that kind of information traverse borders.* (Participant 11 – 8.27)

The country has resources who have a good understanding of every technical field, while specialising in one such field.

> *…so he has a good understanding of everything, and he specialized in one thing.* (Participant 1 – 1.40)

Another SVR is niche skills. Historically, niche skills were an SVR. However, since 1994 many niche skills have been lost as a result of the brain drain.

> *I am talking here about trying to get South Africa as a proper destination where you can do a manufacturing company because we will give you the skills.* (Participant 12 – 12.59)

South Africa also has a young workforce that can be leveraged to provide a competitive edge.

> *But in comparison, if you look at South Africa, our average population age is very young. So, we are the next workforce.* (Participant 1 – 1.45)

Another SVR is mobile services, which help provide competitive advantage in the service sector.

> *Absolutely, it becomes the industry of industries. A very good example, our banking sector is doing very well globally, especially when it comes to innovations like mobile banking and things like that, it is because the mobile industry of South Africa has enabled that.* (Participant 4 – 3.12)

> *…we have now looked at two strategically valuable sources, mobile services, brand, right. Now, on top of that, what about patent?* (Participant 4 – 3.13)

It is easy to develop mobile applications to provide services.

> *…mobile apps – that's also a simple thing to do.* (Participant 11 – 8.86)

Mobile services played a critical role in contact tracing during the COVID-19 pandemic.

> *Well, it's to necessarily location-based services. But the cellular companies are working with government to provide the information that they need for individuals in terms of their tracking Covid App – for me, while there might have been, I don't know, 500 000 downloads or whatever – maybe even a million.* (Participant 9 – 11.69)

Creativity and innovation are considered strategically valuable resources (SVRs) in the service sector. But some participants feel dependency on multinational suppliers drives down local creativity and innovation.

> *I think we have an innovation capability in this country which is, I consider sometimes, better than the rest of the world. (*Participant 1 – 1.14)

Few South African companies were cited for their creativity and innovation.

> *So if you just look at the company like Dimension Data, I think the thing that makes a company very competitive is diverse skills set. The one strategic advantage in South Africa is South Africans are exceptionally – especially in the technology industries and ICT – exceptionally creative.* (Participant 5 – 4.5)

> *I mean, Discovery seems to have – do very well locally; they're very innovative.* (Participant 2 – 6.35)

Entrepreneurship is considered another SVR. Some participants feel there is a support ecosystem for start-ups. Start-ups are considered drivers of innovation. However other participants believe government policies are not conducive for start-ups.

> *You know, Mark Shuttleworth's start-up and then there were other, I think, is it PayPal or something?* (Participant 1 – 1.51)

> *…of the other challenges, you know, is the whole area around political transformation and when, even when you look at the SME front, I mean the entrepreneurs who really need the money and can leverage from the money are not the ones who fit the profile of that policy.* (Participant 5 – 4.59)

Incubation centres and intellectual property in the universities are considered to be strategically valuable resources (SVRs).

> *…in fact, every university now have incubation centres where you go and you bring your start-up and you get it going.* (Participant 6 – 5.40)

> *I mean there's very good IPs sitting in universities, I know some of the universities are grappling with it, but if you can't release the good research and IP in universities to stimulate new start-ups in the technology space.* (Participant 5 – 4.61)

Motivation is considered by some participants to be an SVR.

> *Discovery Health, that are South African companies that have been able to create something and then take it abroad.* (Participant 8 – 9.48)

> *…reason in the areas we are competitive is, innovation and also motivation. Possibly multitasking.* (Participant 1 – 1.22)

Other participants, however, state that local motivation is lacking when compared to multinationals.

> *…we have this attitude of somebody owes us a job.* (Participant 1 – 1.2)

Diversity is considered to be an SVR.

> *That the more diversity you're bringing in opinions when you're looking at a problem, the more creative your solutions would be because of the power of association.* (Participant 5 – 4.10)

Multitasking is perceived as another SVR.

…possibly multi-tasking. (Participant 1 – 1.23)

Where the test manager was maybe also the business consultant and sometimes will also be the project manager. (Participant 1 – 1.25)

South Africa's ICT industry is general has mature processes, and this factor is considered to be an SVR.

We compete fairly well, we're even better than certain developed countries in certain cases and that basically boils down to us having very mature processes to service customers. (Participant 6 – 5.4)

During the Covid-19 epidemic, mobile operators have been utilising location-based systems (LBS) to track infections.

…but the cellular companies are working with government to provide the information that they need for individuals in terms of their tracking. (Participant 9 – 11.69)

*…we're one of five countries that's got advanced levels of this tracking. (*Participant 9 – 11.79)

5.3. Strategically valuable resources (SVRs) of multinationals

In this section, strategically valuable resources (SVRs) that make multinationals operating in the South African ICT industry competitive are determined.

Cost-effectiveness, research and development, education, internal training, entrepreneurs, innovation, availability of international resources, skills, financing, knowledge pools, teamwork, balancing of costs and resources, long-term planning, training and technology are considered by participants as the strategically valuable resources (SVRs) of multinationals. In addition, Western multinationals, and China and India as countries, have their particular strategically valuable resources (SVRs). China has work attitude and customer-first attitude as country-based SVRs. India has integrated technical and functional (techno-functional) skills.

Workers in multinationals are seen as having strong work ethics and motivation.

> *But when they are here, they display this hunger to work hard and to make a success of whatever projects.* (Participant 1 – 1.7)

> *…even their work ethics, it adds to the problem, because they can do impossible tasks, those guys, if you put them in a project. They are forever going.* (Participant 3 – 2.6)

Government planning means Chinese multinationals have efficient supply chains.

> *China has put a lot of money in that I don't even think we can ever catch up, to make sure that companies exist within that eco-system to service other companies.* (Participant 6 – 5.15)

Generally, multinationals exhibit creativity and innovation.

> *They are creative and they are in fact becoming even more so, so they are innovative and they are becoming more innovative.* (Participant 6 – 5.28)

Most of the participants stress the importance of cost-effectiveness as an SVR for multinationals. Multinationals have cost-effective products and resources. Although Western multinationals are less cost-effective than Chinese or Indian multinationals, they can still obtain resources offshore. Western multinationals manage costs by mixing expensive Western or Western-based team leaders with cheaper technical staff from the developing world.

> *And what's happening now, because they can even support us from offshore, offshore resources are very cheap compared to our standard of developers in South Africa. The cost plays a very big role as well.* (Participant 3 – 2.15)

> *…so obviously cost plays a very large role.* (Participant 6 – 4.17)

Training and personal development at the company's cost is a SVR for multinationals. Multinationals consider training to be a capital expenditure.

> *…but they are offering the courses and access for courses to their employees at a reasonable cost or in some cases, free, that the employees can be skilled up in specific new areas that may be popping up.* (Participant 5 – 4.47)

Multinationals are well resourced.

> *American technology sector is quite well resourced, quite well funded, quite well developed. Now, the Chinese are coming in and in terms of resources the Indians also play quite a big role in providing human resources.* (Participant 2 – 6.5)

In the case of Chinese and Indian multinationals, companies mostly source their resources internally. Western multinationals obtain their resources using the off-shoring model. There are global partnerships and, likewise, global reach.

> *Global partnerships, global experience and therefore global reach, which means they have access to multinationals already and use multinationals. And the third one would be the off-shoring model.* (Participant 9 – 9.35)

Government and private sector funding are strategically valuable resources (SVRs) for multinationals. Government funding or government-assisted funding is a major SVR for Chinese multinationals. Chinese banks such as Exim bank are state-owned.

> *…you can see how the Chinese Government stood behind Huawei with these sanctions that America imposed.* (Participant 11 – 8.69)

> *Chinese banks usually they give loans to their guys on a very low interest.* (Participant 14 – 17.17)

But the US government also funds US technical companies.

> *American Government pumps money into their tech companies, into patents.* (Participant 10 – 7.39)

> *The autonomous drive himself was funded by the government in the US.* (Participant 12 – 12.39)

Multinationals have the advantage of being established and experienced companies with brand value, and can persuade companies to accept their offers. They have vast knowledge pools with global reach, hold patents and are original equipment manufacturers (OEMs).

> *OEMs themselves as multinationals or multi-national SIs [System Integrators] tend to be quite dominant.* (Participant 8 – 9.5)

> *OEMs for the software, for example, Google, RBG, or Microsoft, those companies, where they are very particular about who can actually work on their software.* (Participant 8 – 9.3)

Multinationals also utilise automation and artificial intelligence.

> *Secondly, I participate into transformation projects that say automation.* (Participant 13 – 16.3)

> *I learnt automation anyway at a laboratory process automation platform and got certified on that. Also, we were a part in Cloud, if you say, Azure and AWS, which is a part of passion.* (Participant 13 – 16.3)

Centres of excellence and feeder universities are also associated with multinationals.

> *The competitiveness sways toward the traditional big players, so the IBMs, the Accenture, the multinationals, because they are certified for centres of excellence.* (Participant 8 – 9.4)

> *Huawei's got their own university. It's something that, for a multinational of that size, right, it was very strategic for them to think about, you know – that's the feeder system into the corporate world, right? (*Participant 9 – 11.52)

Tailor-made programmes for industries are also associated with multinationals.

> *They are tailor-made, exactly, they are tailor-made.* (Participant 13 – 16.66)

Research and development centres are strategically valuable resources (SVRs) for multinationals, specifically in the case of Chinese MNCs.

> *…but they have access to like a plethora of knowledge and information that resides in R&D, in China.* (Participant 11 – 8.42)

> *…because you are at the forefront; you've got the R&D exposure, but you influence your tertiary stream. So, the point I'm trying to make is, I agree one hundred percent that that's a strategic advantage for them.* (Participant 9 – 11.5)

Chinese multinationals in particular focus on delivery and turnaround times. Indian multinationals offer fixed contracts to absorb delivery risks.

> *I said, large deployments, especially multi-year deployment where, you know, OEMs evolved, multinationals dominate.* (Participant 8 – 9.6)

> *But still there are certain factors in terms of if you look from the global landscape to get to that particular level of skill, with the affordable cost, with the guaranteed delivery timeline the way the customers agree to the companies.* (Participant 13 – 16.27)

Knowledge-sharing and collaboration between resources is an SVR for multinationals.

> *…the ability to do massive knowledge-sharing and collaboration internally and learning from one another what they're doing in other markets in how to be competitive; and yes, cost.* (Participant 5 – 4.38)

Currency exposure is also an SVR for multinationals as multinationals charge in US dollars for work and products. Compared to the Rand, the US dollar has been stable.

> *It is currency exposure. So multinationals, when they come to South Africa, whether they are getting their resources from China, from India, they charge us in US dollars.* (Participant 8 – 9.37)

Multinationals are also looking at the long game and have an appetite for risk.

> *I think they've got the courage, they've got the risk appetite and they are looking at the long game like the Chinese, they are not looking at the short games.* (Participant 7 – 10.11)

For multinationals, economies of scale are an SVR. Economies of scale help in manufacturing, software development, etc. Both China and India have large markets for multinational products and services.

> *They are generally after the economies of scale where there are obviously large volumes that they can use and large volumes they can sell.* (Participant 12 – 12.20)

Finally, the study shows that multinationals have SVRs that are in many cases specific to the country. In addition, positive government policies, including support to entrepreneurs, also play a major role in the competitiveness of multinationals.

5.4. Required strategically valuable resources (SVRs)

As shown in Chapter 4, there is a consensus that the South African ICT industry is competitive in the ICT service sector. At the same time, the South African ICT industry is not competitive in the ICT manufacturing and software development sectors. Current SVRs that make the South African ICT service sector competitive can be utilised in the ICT manufacturing and software development sectors. These SVRs are mobile services, delivery, project management, processes, multitasking, young workforce, intellectual properties in the universities, brand, niche skills, mobile services, location-based systems, creativity and innovation.

In this section the researcher also looks at new opportunities in the South African ICT service sector and the required SVRs.

Delivery and project management are specifically important as SVRs. They are also due to leadership qualities of project managers.

> *So South Africa, we're very good in driving delivery. We drive… Hence you see our project managers growing to go and work in the other countries, but from a leadership perspective, we are good with working with people in South Africa, because we are sensitive, we are high in IQ as a country. I think the leadership*

element is there and we drive strategy that will be cause to, and we understand the people and we work well with them. (Participant 3 – 2.30)

Other factors can also become SVRs. These include start-ups and entrepreneurships, education, training, data costs and network coverage.

Start-ups and entrepreneurships need to be supported by government policies and funding from both government and private sectors, as seen in the support given to multinationals. To level the playing field, the same rules must be applied. Government must embark on a serious effort to make the South African ICT industry competitive by supporting start-ups and entrepreneurs, coding schools and training. In addition, by releasing spectrum and lowering data costs it can unleash potential across the whole country. Further, by fostering cooperation between universities and the private sector to leverage the intellectual property held by the universities, it can assist creativity and innovation.

So, are we just focused on the urban areas? Because yes, for you and me, we don't know that there is a data problem. We are here at our home, we've got fast Internet and affordable for us, but outside of these cities, it's not. So, I think access and then cost is an issue. All of the experience is improving, costs are going out. I'm not going to get into the debate whether it's going down fast enough or not. But I think the point I want to highlight is that there clearly is the need for it. (Participant 1 – 1.58)

Start-ups are strategically valuable resources (SVRs).

Which is why I think in the start-up scene in South Africa, with some of the younger entrepreneurs coming up, you see a lot more increase in different types of skill sets, because they have to in order to survive – have to link up with other ecosystems. (Participant 5 – 4.35)

Unfortunately, the elaborate and long process to register a company, get a VAT number, and a custom import/export code, defeats the purpose. It is essential that the government should streamline policies to on-board start-ups or small to medium industries (SMEs) and offer assistance such as tax benefits and funding.

If you and I had a business idea, and we want to register it, how long does it take for you and me to start a company and have it registered? (Participant 1 – 1.52)

…what is the challenge for start-ups to be successful need a couple of things. First, they need good funding and what a lot of start-ups don't do properly is when they start up is get sufficient funding off the ground. (Participant 5 – 4.51)

SMEs are the way to go, think some participants.

…in fact, not start-ups, small – medium enterprises is the way to go, not start-ups. Meaning we know as a proven fact around the world, two-thirds of the nation is employed by small and medium enterprises, it is not employed by this big corporation. (Participant 6 – 5.39)

Leverage financial services as an SVR to create the investment to become competitive, is another suggestion.

…financial services capabilities, that we've got, to create that investment locally in order for us to take it outside. (Participant 2 – 6.32)

We already have innovation hubs. But they need to be converted into start-ups with the help of intellectual property residing in the universities. Start-ups drive creativity and innovation. Creativity and innovation are determined to be strategically valuable resources (SVRs) in the South African ICT service industry.

I think start-up companies is very important in any marketplace, you know, they drive innovation. (Participant 2 – 6.51)

Government intervention is required in the form of new policies. In addition, the service sector should reinvest in the country.

…there's lots of these innovation hubs that come up, you know, to try and get people to start their businesses, and so those are the support structures that we need more than just finance. (Participant 2 – 6.53)

> *So, from a service sector, you know, I mean, I do feel that only a tiny portion is put back into the country and I mean, let's say this is specific for telcos.* (Participant 11 – 8.26)

Research and development is a required SVR. As shown in the earlier section, R&D was determined to be an SVR for multinationals. However, in South Africa tax incentives are insufficient to encourage R&D. Companies look for alternatives to tax relief.

> *I think we went through a whole exercise where we tried to prove what portions of R&D were done internally versus bought, and the tax incentive was so little that eventually we actually scattered the whole project, and I think from a tax incentive perspective they focused more on the community service, those kind of initiatives, I think because it was a much better tax relief than the R&D – and I think that's sort of slowly what drove the innovation within the country down.* (Participant 11 – 8.17)

It is imperative that the government should encourage R&D by providing tax incentives to those operations that embark on R&D, or through providing funds for R&D in collaboration with universities.

Both financial services and telcos that are successful and able to invest should also finance R&D in universities or leverage the existing intellectual properties in the universities.

Looking at education, South Africa has areas with an abundance of skills that are not being correctly utilised. Skilled staff are not doing the appropriate work to make the most of their skills and education.

> *I suspect when you go to countries like China, engineers are doing real engineer work. I know for a fact, I'm in certain classes with American students, they are doing real engineering work. When you talk about aerospace, you're talking about aerospace engineering, you're talking about manufacturing. Engineers are doing real engineering work.* (Participant 7 – 10.44)

There are areas where the country lacks sufficient skills. South Africa lacks affordable programmers. Computer science graduates from the universities are doing coding when they should be doing analysis. Coding schools can help here. Post-matriculants can be trained as programmers and sourced from coding schools at an affordable cost.

> *That guy that comes out of the coding school, if he is bright and works hard, he could walk into a relatively good-paying job because we don't have enough developers, you don't have to sit three years on university learning some degree that is probably not going to help you, really. That is something that we – we need to break out from this old school of thinking that, because you studied and you have a degree, you're clever.* (Participant 1 – 1.43)

One participant commented extensively on the historical examples of colleges outside tertiary education producing good programmers.

> *…because if you look back when I started working there was this school and college called Van Zyl and Pritchard. Some of us we went to the technikon and university for four years, and yet Van Zyl and Pritchard produced a very good number of programmers who were just trained to do programming. So I think it's an idea that can work, because if you take a good child with matric and you train them how to program for the entry level of programming, most of our best Cobol programmers, they came from Van Zyl and Pritchard, they didn't go to university for four years. So I really think that's a brilliant idea.* (Participant 3 – 2.27)

Other participants also believe that there is no need to have a university degree to be come a programmer.

> *Absolutely, that's a very practical approach to things, you do not need an undergraduate degree to be a very good coder or programmer.* (Participant 4 – 3.24)

> *We should rather find more innovative ways, we should encourage companies to take on internships more, you know, in order to develop these people, instead*

of saying: "You know what, you didn't go to university, so tough for you, we don't need you". (Participant 2 – 6.42)

Some of the work now being done overseas can be carried out by coding school graduates. This includes web development and mobile applications.

…instead of buying simple, you know, like small companies that have to buy, you know, out-of-the-box things from overseas – we can do web development, I mean, web pages is simple to do. (Participant 11 – 8.84)

…mobile apps – that's also a simple thing to do. (Participant 11 – 8.86)

We have a young workforce.

it is known Africa has got the youngest population. Even if you don't focus on Africa, but at least reference, that can help others to now be able to explore those areas and how we can become even much more powerful as South Africa, as a part of the bigger continent of course. (Participant 6 – 5.42)

Once the country has affordable skills, South Africa can become a manufacturing destination.

We need to start marketing South Africa as a destination. And I am not talking about trying to get $500 billion of investment in the country. I am talking here about trying to get South Africa as a proper destination where you can do a manufacturing company because we will give you the skills. (Participant 12 – 12.59)

Government policies need to be oriented towards retaining skills.

At the same time, creativity and innovation should focus on local solutions.

There must be clever solutions that we can put in place that will make sure that we can still deliver electricity, there won't be illegal connections and everybody is happy. So leave it to the local people to think about those types of solutions, don't go and get somebody from Italy to come and try it. (Participant 7 – 10.52)

Adopting new technologies can create more jobs.

> *…you can create much more jobs by adopting technology, than doing the same thing with old technology.* (Participant 10 – 7.40)

Processes are becoming automated and modernised. These are current strategically valuable resources (SVRs) that can be leveraged to become competitive in the production sector. Similarly, brands that are current SVRs can be leveraged to become competitive in the production sector.

Call centres can become SVRs for all sectors. Call centres in South Africa are cheaper than those in Europe or North America and are in an ideal time zone to cater for customers in those countries. Call centres now being set up for company-specific customers can be easily converted into catering for overseas customers of overseas companies. South Africans have an excellent quality of service and good command of the English language. For these reasons South African call centres are preferred over cheaper call centres in Asia or North Africa. By providing quality service, Call Centre agents can provide remediation in a single call, at an affordable cost, compared to call centres in Asia or North Africa. In addition from an understanding of the accent point of view, South African call centre agents are better understood in UK or Australia compared to those in Asian or North African call centres.

> *We actually had a perfect time zone here for Europe, so we could have done it very easy here and covered the entire Europe call centre reasonably cheaply.* (Participant 12 – 12.62)

> *Now, for the cost-basing, the call centre, because True Health was operating in the UK, and through all the shops we had our sales on there. But we did the call centre from Johannesburg, from Sandton, because it was cheaper than in London. For me that makes sense.* (Participant 1 – 1.33)

Call centres can add value to existing ICT industry service or production to attract foreign investment and collaboration.

The South African ICT service sector – specifically the mobile and finance sectors – has large customer bases.

These customer bases can be strategically valuable resources (SVRs) for the entire ICT industry. A customer base can be mined, can be used as big data, can generate artificial intelligence products, test new products and be used for new technology opportunities.

> *They have tens of millions in terms of customer base. It is a strategic asset.* (Participant 8 – 9.39)

South Africa is self-sufficient in energy resources such as coal, also renewable energy resources such as solar and wind power. As the world moves away from coal because of climate change, South Africa can leverage its renewable energy resources as SVRs for the local ICT industry. South Africa's ICT industry can use renewable energy or produce renewable energy products that are considered emerging technologies in the 4IR.

> *We shouldn't be energy-deficient, because we are a very sunny country; and solar energy and wind energy are very practical examples that could be harnessed in South Africa and be used as a competitive advantage.* (Participant 8 – 9.49)

The Internet of Things is another strategically valuable resource for the South African ICT industry. Currently, industry is buying IoT products from abroad. With sufficient government support, IoT products could be produced locally.

> *Because imagine if you say, you know, everything that you do at Transnet, everything that you do at Eskom, the IoT angle, Transnet… I mean there's many technologies that can be applied in that space. So if the government attitude in the departments that drive policy and regulation in this space really, really push for ICT, it means that more and more South African ICT companies will be competitive, but I really think the big catalyst has to be the government itself.* (Participant 8 – 9.78)

Mobile services have been identified as an SVR for the ICT service sector.

> *So you really then almost have the entire country having a SIM card, so it becomes easy if you already have my SIM card, almost everyone for me to give you a banking service to say everywhere you go you can guarantee you are sending money to someone who has got this thing.* (Participant 8 – 9.58)

Currently, mobile services are used to provide both mobile and financial services.

Mobile services can be used further as an SVR, enabling the entire ICT industry to become competitive.

Participants contend that the South African banking sector is doing well globally because of the country's mobile industry.

> *Absolutely, it becomes the industry of industries. A very good example, our banking sector is doing very well globally, especially when it comes to innovations like mobile banking and things like that, it is because the mobile industry of South Africa has enabled that.* (Participant 4 – 3.12)

Government policies and support such as funding can augment the required strategically valuable resources (SVRs) in the same way government policies and support are boosting the competitiveness of multinationals operating in the South African ICT industry.

Participants also advocate collaboration with multinationals in jump-starting ICT manufacturing and ICT software development.

One form of collaboration is to assemble parts or components in South Africa for multinational products. One participant explained this collaboration in detail.

> *I would like to see that aspect gradually growing with an understanding that if you focus too much on that, you definitely cannot take on a Samsung, a Huawei, an Apple that has built this dominance over time. But I would like to see more collaborations, I would like to see Apple saying: "I might put an Apple phone together in China, but I actually find the capacity to produce this specific*

component in Cape Town". That makes sense and we can actually push for that. (Participant 4 – 3.28)

China started its manufacturing industry by collaboration with multinationals, beginning with parts, followed by modules, and then whole products. Finally, through innovation, China produced its own products.

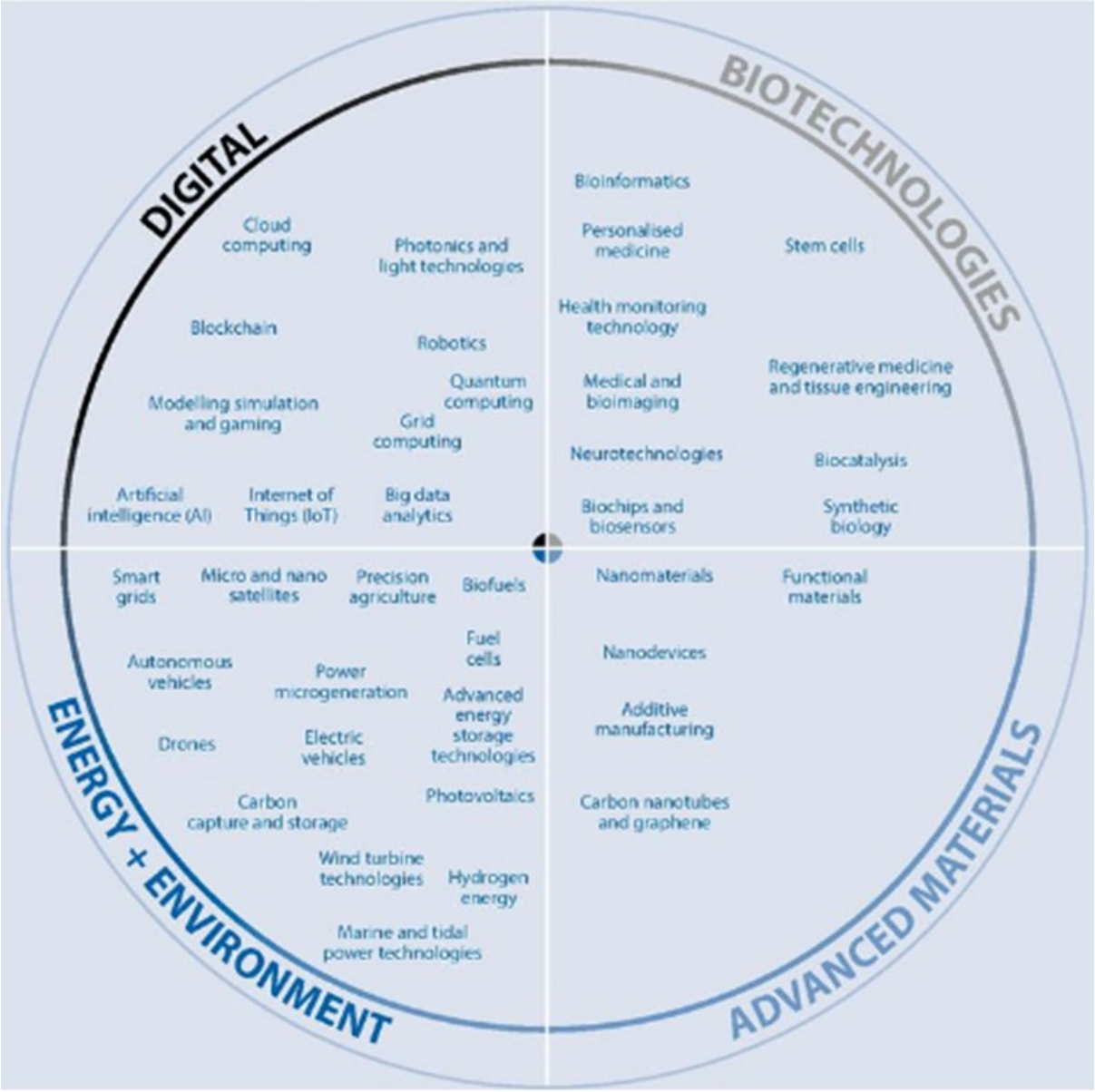
5.4.1. Emerging technologies of 4IR

Emerging technologies of the 4IR can be strategically valuable resources (SVRs) for South Africa's ICT industry. By adopting suitable emerging technology, the South African ICT industry can become competitive.

The Fourth Industrial Revolution integrates the physical, digital and biological worlds (Schwab, 2017). In the 4IR era, the boundaries between the physical, digital and biological spaces are becoming blurred because of the active convergence between various fields (Jeonghwan & Yongyoon, 2017; Schwab, 2017). No industry or technology sector is more central to the development of the digital economy than the information and communication technology (ICT) sector (Lucas et al., 2009).

Forty technologies are emerging out of the 4IR (OECD, 2016). These are depicted in Figure 14 below. The first, or digital, quadrant depicts emerging ICT technologies. Other quadrants contain emerging technologies in the biological, advance material and environment-friendly energy worlds (OECD, 2016). ICT-based convergent industries of the 4IR drive the profoundly connected emerging technologies (Chung & Kim, 2016; Schwab, 2017). Emerging technologies produce their own technological capabilities. Emerging technologies and their categorisation are shown in Figure 15 below.

Figure 15: 40 key emerging technologies of the 4IR



Source: OECD (2016).

Reviewing some of the emerging technology, it is clear that cognitive technologies are increasingly being used to solve business problems (Davenport & Ronanki, 2018). Cognitive technologies are products of artificial intelligence (Schatsky et al., 2015). In the US, the White House announced the creation of an Artificial Intelligence task force involving both the ICT industry and US federal authorities (Vanian, 2018). Meanwhile in China, the city of Tianjin set up a $16 billion artificial intelligence fund, with the aim of becoming the world leader in artificial intelligence by 2025 (Reuters, 2018). Tianjin

will use the fund for intelligent robots, hardware and software as a key to other emerging technologies. Another digital emerging technology is Blockchain. Blockchain technology allows all stages of transactions to be securely shared between network members, as opposed to banks working independently, which is more expensive and increases the chances of error and fraud (Phartyal & Tripathy, 2018; Prathyusha, Kavya, & Akshita, 2018). India's second-largest ICT MNC, Infosys, has set up a Blockchain-based trade and finance network with seven banks in India. Infosys is also negotiating with Australian banks to join the network. It is expected that mobile and wireless traffic volume will increase a thousand-fold over the next decade, driven by the 50 billion devices connected to the cloud by 2020 – all of which need to access and share data, anywhere and at any time (Gupta & Jha, 2015). In the biological world, emerging technologies can perform parallel rather than serial analyses, which can help to identify distinctive patterns and multiple cancer markers rather than merely a single cancer marker (Kulasingam & Diamandis, 2008). Nanotechnology (NT) is known is a rapidly expanding field focused on the creation of functional materials, devices and systems through the control of matter on the nanometre scale (Mnyusiwalla, Daar, & Singer, 2003). Despite the obvious benefits of emerging technologies, government commitments to 4IR remain low even in developed countries (Liao, Loures, Deschamps, Brezinski, & Venâncio, 2018).

A critique of emerging technologies asserted that artificial intelligence cannot currently replace the full gamut of human intelligence or achieve singularity in the near term (Goertzel, 2007). The renowned physicist Stephen Hawking said the emergence of AI was the worst event in the history of mankind – unless its development was controlled. He also thought computers could in theory emulate human intelligence and even exceed it (Hawking, 2017). Applications based on machine learning reflect existing social biases and prejudice (Aneja, 2018). This means data bias and unequal access to technology will only entrench existing socio-economic inequalities, even as AI learns (Aneja, 2018). Although cryptographic protocols offer attractive privacy solutions on a blockchain, they are not yet sufficiently mature to run general-purpose computations easily or to be widely deployed (Brandenburger, Cachin, Kapitza, & Sorniotti, 2018). Blockchain presents challenges that limit performance (Fynn & Pedone, 2018). There

are also claims that two-thirds of the jobs in the developing world could be lost to automation resulting from the 4IR (Younus, 2017).

5.4.2. South Africa's application of emerging technologies

South Africa has started developing and applying the emerging technologies of the 4IR. The South African Reserve Bank recently successfully completed Blockchain proof of concept (SARB, 2018). Proof of concept demonstrated a capability to process twice as many transactions as the current system in the same time frame. The Commonwealth Bank of Australia has proposed importing the "commercialised blockchain solution" that was successfully tested in South Africa (Nott, 2018). De Beers has started using Blockchain to span the entire diamond value chain (Anglo American, 2018). Blockchain technology is an emerging digital technology. The South African start-up Tari Labs is promoting its Tari protocol for Blockchain, to be used in ticketing applications in the US (McKane, 2018). Cloud computing is another emerging technology among South African businesses that is yet to become fully utilised (Pazvakavambwa, 2018). South Africa is using drones to prevent corruption on construction sites (Chutel, 2018) and fight poaching in nature reserves (ibtimes, 2016). As early as 1993 a South African company was offering anti-radar drones to foreign countries ("South Africa offering anti-radar drone," 1993).

The Cape Town University of Technology (CPUT) launched an advanced microsatellite in April 2018 (CPUT, 2018). This was followed by the launch of a constellation of three nanosatellites on 12th August 2022 abroad Elon Musk's SpaceX (Kevin, 2022). This is the first time a constellation of satellites had been launched. They will greatly improve South Africa's maritime surveillance. South Africa's Square Kilometre Array telescope relies on multiple technologies (Gastrow et al., 2016). Recently the South African Government signed agreements with independent power producers (IPPs) to procure environmentally friendly power (Sibongile, 2018). This includes wind using wind turbines – another emerging technology.

South Africa is one of the six leaders on the continent in the use of emerging technologies (Chakravorti & Chaturvedi, 2019). For example, the country uses

biometric data and payment cards to deliver social security grants, and drones to help keep mines innovative.

South Africa has been an active participant in the exploration of space since the dawn of the Space Age (UCT, 2021). From the 1950s to the 1970s, satellites were tracked to determine the effects of the upper atmosphere on their orbits. Lunar and interplanetary missions were supported from a tracking station at Hartebeesthoek, northwest of Johannesburg. Images of the planet Mars taken by the Mariner IV spacecraft – the first close-up images of Mars and also the first close-up images of another planet – were received at the Hartebeesthoek Radio Astronomy Observatory. South African ground-based facilities have continued to support various space missions ever since.

From 1999 the University of Stellenbosch has been launching microsatellites in the SUNSAT (Stellenbosch UNiversity SATellite) series (Montenbruck et al., 2004). In addition, multiple space services are being launched in South Africa, building on the experience of microsatellites (Admire, 2021).

The inauguration of one of the world's leading specialists in artificial intelligence, Tshilidzi Marwala, as vice chancellor of a South African university (the University of Johannesburg) brought the 4IR to the fore in local media and raised interest in what the 4IR might mean for education in general – and particularly for post-school education (Butler-Adam, 2018).

Mobile operators are getting involved in FinTech services. After the failure of M-Pesa, Vodacom has been planning to introduce a new super-app for FinTech services (Tage, 2020). The advent of a digital WhatsApp wallet could accelerate FinTech services. Telkom is planning such a WhatsApp wallet (Gavaza, 2021).

Drones are an emerging technology that can significantly improve the competitiveness of the South African ICT industry. Currently drones are primarily used for aerial photography, although their potential applications are extremely wide. The recent Azerbaijan-Armenia war demonstrated the use of combat drones as against the use of conventional air power. Food and vaccines can be delivered by drones to otherwise

inaccessible regions. Drones can monitor projects without visiting them. This is a significant use in South Africa where government is struggling to deliver on infrastructure projects, especially in the education and housing sectors. Drones can provide an independent view for central government planners, treasury and government auditors on the actual state of projects sanctioned by Pretoria. Mapping can be undertaken by drones, which can also generate 3D views of buildings under construction. Road survey teams and real estate businesses can utilize drones. Drones can be used for agricultural deliveries, to assess crop damage, spray fertilisers or pesticides, and tackle insect onslaughts. Asset management in factories and on construction projects can be facilitated by drones. Drones can help with the maintenance of tall structures, including oil refineries.

Smart homes can use drones. Autonomous devices can be used as remote eye for security purposes. With the rapid growth of artificial intelligence and facial recognition, the autonomy and sophistication of drones will proportionately increase. One area where drones can play a major role is in policing, by helping with patrolling, riot control, rapid reaction and announcements. South African mines are already using drones for mapping purposes. One current limitation of drones is their inability to work in areas where GPS is not available. However smart drones are being developed that are fitted with sensors to work inside hazardous and closed areas.

South African ICT can be involved in drone manufacturing, identifying application areas, and developing drone applications that are unique to South Africa and the continent. The South African Civil Aviation Authority and other government agencies will have to develop rules and processes to regulate the use of drones as uncontrolled usage can lead to disaster.

To conclude this section, there are 40 emerging technologies available for the South African ICT industry to help develop global competitiveness. Start-ups can develop and apply emerging technologies as in the host cost countries of multinationals. At the same time, many authors point out the practical difficulties involved in implementing emerging technologies in the country. South Africa has a significant skills shortage caused by failings in its education system: this limits the supply of managers, researchers and workers needed for developing and managing emerging technologies

(Sutherland, 2020). There are also problems with poor infrastructure, reflecting weak governance and state capture. The country has a poor record in policy formulation and implementation, especially across departments, with notable delays to cybersecurity and data protection (Sutherland, 2020). There is only a small domestic market, and, despite aspirations, it is not an open gateway to the rest of Africa, which has strong demographic growth but limited spending power and poor physical distribution systems. Moreover, South African firms have to compete with a strong Chinese, Indian and Western presence.

5.4.3. Government policies and the 4IR

Emerging technologies of the 4IR can be turned into strategically valuable resources (SVRs).

> *You talked about the Fourth Industrial Revolution. What are we doing about it in our policies? It's very much important that we continuously advance or improve our government policies in terms of ICT.* (Participant 3 – 2.32)

Government needs to expend more effort on training, specifically by setting up coding schools, for South Africa to successfully embark on the 4IR.

> *So, I think from that perspective that makes me excited to see, that we're starting a lot of these (coding) schools and we're starting it young. I think some of them are now trying to get into the school level even to do that. If we can start turning out some practical skills, and I don't know if you're going to get to the Fourth Industrial Revolution later, but if we want to start playing there, this is the type of training we need to do today. Not in a few years' time. We need to start now, to get.* (Participant 1 – 1.44)

Other major challenges should also be addressed by government to facilitate successful embarkation on the 4IR, according to participants.

> *If we want to speak Fourth Industrial Revolution, but are we just saying Fourth Industrial Revolution, or are we doing that for real? To participate we need to be online, and we need to have access to information. All these coding schools,*

all these guys, they need access to the Internet to learn, to find out from other peers around the world, to apply for jobs. (Participant 1 – 1.61)

And that touches every single enterprise,. There's way too much about it, it's the same with the buzz about digital transformation which most companies still, after 15 years, have not been able to implement properly. (Participant 5 – 4.71)

You talked about the Fourth Industrial Revolution: what are we doing about it in our policies? It's very much important that we continuously advance or improve our government policies in terms of ICT. (Participant 3 – 2.32)

The emergence of environment-friendly alternative energy technologies is an indication of effective government environmental regulation. Technologies such as biofuels, electric vehicles, wind turbines and hydrogen energy are all outcomes of government environmental regulation (Schwab, 2010). There is strong evidence that of a relationship between regulation and competitiveness (Porter & Van der Linde, 1995). Environment-friendly government policies and regulations have led to emerging technologies in the 4IR. Studies of US manufacturing come to the conclusion that environmental regulation does not impact competitiveness negatively (Jaffe et al., 1995).

Government intervention to protect an industry may not be in the best interests of the country (Krugman, 1992). Though strategic trade policy supports interventionist policies that are desirable for domestic firms, at a country level this may lead to a counter-reaction by other countries and thus ignite a spiral of protectionist policies (Smit, 2010). This has been noted in the case of recent trade wars between the US and other developed and emerging countries.

Government interventions on ICT infrastructure to assist a local ICT sector have happened multiple times around the world (Lucas et al., 2009). A prime example involves the setting up of an ICT cluster. The Indian Government played a major role in setting up ICT clusters in Bangalore, Hyderabad and Chennai (Grondeau, 2007). Similarly, the Chinese Government was heavily involved in setting up an ICT cluster in Shenzhen (Wang et al., 2010).

South Africa's Competition Commission embarked on an inquiry into data costs in South Africa (Phillips, 2018). This inquiry was completed in 2019. Recommendations were made to reduce costs. Operators reduced costs.

5.4.4. Government policies, regulations and funding to support ICT industry

Some government policies were criticised. These policies are particularly sensitive. This being the case, criticisms and opinions are quoted at length.

Participants feel government should take serious steps to address competitiveness.

> *Government institutions to regulate, to force that kind of innovation to happen.* (Participant 11 – 8.13)

> *The challenge is – I do believe we're making inroads there, even from a cellular operator perspective; there's just because you own a license remember you are meant to provide schools with access to technology and infrastructure, at no cost.* (Participant 9 – 11.63)

Better partnerships between government and corporate sector.

> *So, I believe that there is, there is some work being done in the space, from a government policy perspective, but I honestly think you need better partnerships between government and, you know, corporations for this to work. I believe you need to incentivise the corporations a bit more.* (Participant 9 – 11.78)

Previous steps by government to encourage competitiveness were inadequate, participants believe.

> …*few years ago they tried it by giving, let's say discounts to, and tax incentives to, all the ICT sector for any R&D that happened in South Africa, but it was very negligible*. (Participant 11 – 8.14)

There is a concern that current regulations and laws are insufficient to encourage competitiveness.

> *…there seemed to have been this attitude of the employees that something like bonuses is a human right. So if you come in with that attitude of irrespective of how you perform and how you get compensated and there's just this expectation that you need to get a compensation even if the company's maybe struggling financially, you know, you just stifle a lot of things there.* (Participant 5 – 4.34)

Failure of the government to take decisions at the right time has led to lost opportunities.

> *If you talk about manufacturing. ICT-wise, I mean we had this whole idea about starting call centres here, but government could not make up their minds, so that whole call centre thing went to India, so now everybody has a call centre in India unfortunately.* (Participant 12 – 12.61)

> *Competitiveness was born in that growth region, why is it not born here.* (Participant 12 – 12.66)

Empowerment laws – specifically Black Economic Empowerment (BEEE) – came in for criticism. Criticisms were very detailed and explanatory. As such the remarks are provided in full. Some participants feel BEEE is undermining competitiveness.

> *I don't think we South Africans are selected because we're competitive rather than – because of other empowerment issues.* (Participant 11 – 8.22)

> *So, I mean, even if you were within that group that are benefitting now, the fact that you are part of an elite – it may put you at risk in future. And until you see that there's some fundamental change in the thinking of government – of people around it – you would also be wary to keep all your eggs in this basket.* (Participant 11 – 8.71)

Instead of fostering competitiveness, BEEE policy is helping multinationals, some participants believe. BEEE companies are perceived as becoming fronts for multinationals.

> *That's one of the biggest challenges I have, is that you'll find, you know, a company would create let's say a Black-owned company would present themselves as a reseller of a local partner, and then, you know, it's really all Chinese, or whatever company.* (Participant 11 – 8.72)

> *So, I mean, government, and this government, sanction that has made it very easy for people to perform this role and get rich. And that's one of the big headaches, I mean, BEEE should maybe be about employing locals rather than you know, ownership of the company.* (Participant 11 – 8.74)

Some participants feel BEEE policies are detrimental to the competitiveness of the ICT industry. They also see the hiring process as degrading the capability of the entire team. Practical examples were provided in detail.

> *Now, I'm not against BEEE in the sense that it's there to rectify past indifferences and injustices. I think that's a good thing, but I think there's still a negative impact on those that implement it. If I had a target, so I have a small department, I only have 30 people, for example, I inherited it from a previous manager and all 30 are white. Now the one person resigns. I will have a lot of pressure from my HR to replace that person with a BEE candidate because already my department is all white.* (Participant 1 – 1.11).

Other practical problems with BEEE policy are highlighted.

> *I don't think we're always able to make the right decisions and say we're taking the best candidate. Look, it's easy if we started ten years ago if we had ten years to hire 30 people. Over ten years we would have found a mixture of BEE candidates and non-BEEE candidates, and the result would have looked better. But because we're trying to correct past injustices, we now have to sometimes make the wrong decisions.* (Participant 1 – 1.12)

However, other participants expressed positive opinions about BEEE.

> *Affirmative action legislation is actually indirectly a strategic asset, because what it does, it gives the local companies first right of refusal with other large corporates and with government.* (Participant 8 – 9.47)

Further to the criticism of BEEE, the need for government to stand with South African companies is emphasised. The example of the Chinese Government backing Huawei is cited.

> *No, but a significant role I mean, you can see how the Chinese Government stood behind Huawei with these sanctions that America imposed. I mean, I cannot see that happening for a small South African company, or even a big South African company, you know*. (Participant 11 – 8.69)

Some participants perceive a need to regulate multinationals coming to South Africa. Rationale was provided in detail.

> *We need to regulate, for me we need to regulate the way we use multinationals, because if they're not regulated, if they keep on coming to South Africa like a flood, we are going to be end up being users, because if they are regulated, they don't just come here, they need to come here for a really scarce skill. Some of the skills that they come here to do, they are not scarce at all. So we need to regulate and if they come for scarce skills to South Africa, we need to regulate the fact that they can do it for so long and they need to do knowledge transfer and go back.* (Participant 3 – 2.35)

On the other hand, some participants believe current laws are detrimental to multinationals. They have a negative effect on building manufacturing capacity in the country by discouraging multinationals from investing in South Africa's ICT manufacturing sector.

> *Where in South Africa when there is a company coming, and this is my discussion with… you are accountable to train these people. You are accountable to learn them, you are accountable to get them up to speed and*

all of that falls on your shoulders and there is not much government support that comes in, which then makes it from a manufacturing perspective, rather kind of difficult to justify setting up shop here. (Participant 12 – 12.30)

By supporting banks, government is seen as stifling the ICT industry, specifically mobile money, which is an emerging technology.

Government regulation has often stifled rather than helped South African ICT companies, because the government is so loyal to the top four banks, they passed legislation that is highly protective of the top four, of the big four banks, because they see that as the pillar of this economy. Which means that mobile money has been largely stifled in South Africa compared to other markets where it has been very successful. (Participant 8 – 9.71)

Participants emphasise the importance of data to the economy.

There's a direct correlation between access to data and GDP. That might be applicable if you are going to talk about that subject. (Participant 1 – 1.59)

According to many participants, government is dragging its feet on allocating new spectrum to mobile operators. This is detrimental to the ICT industry and the economy.

…new spectrum, the new bands that are going to go on auction. Schools is one, but remember you've got increased broadband usage because of the work-from-home scenario, as an example. But who picks up the bill – the individual or the corporate? You still need the broadband resource as a telco. So, if you don't have it, how do you actually make it available? (Participant 9 – 11.66)

Better collaboration to stimulate more innovation, if you ask me, definitely the resolution of high-demand spectrum would go a long way, we are very positive that's about to be resolved. (Participant 4 – 3.26)

Participants are concerned by the state of education and skills in South Africa.

> *So for skilling, the government can do a lot in the universities, you know, in some cases affordable education, but government doesn't have the tax base to do that, so I think private industry needs to play a larger role as well in that. So access to be able to skill up, the biggest challenge is our school education. I mean the whole education system has fallen down to nearly nothing.* (Participant 5 – 4.55)

> *When it comes to university and skilling-up, especially with companies, I think private corporations already do a lot, so the thing is just how do you apply the 5 percent economic development funds that go to companies in more sensible ways? And I don't think Government should manage that. I think there needs to be some policies to say: "Okay fine, for the guys in the ICT side…" Which is what the universal service access fund was supposed to address – need to focus their resources on how they do that*. (Participant 5 – 4.57)

Participants highlight the problems South Africa faces compared to other Third World countries. One issue is that skilled labour is expensive.

> *If you have proper skilled labour, they are still sought after that it becomes costly to retain highly skilled labour. Especially if you need them locally. So, that is unfortunately where South Africa currently has a very big disadvantage compared to setting up a manufacturing shop in a place like India, China or Philippines, you know any one of those countries, where it is, where resources, where the people are trained and going to university or having a college degree or is very common or more sought after, from the population, that necessities South Africa.* (Participant 12 – 12.28)

Another is that systems and processes are comparatively less welcoming towards multinationals.

> *I see they have the systems and processes from the government perspective to just be more friendly towards welcoming these companies in.* (Participant 12 – 12.28)

Some participants point out that education and training in the telecommunications sector have gone a long way towards developing the necessary skills. This has led to the ICT service sector – specifically telecommunications – becoming competitive.

> *If you look at the level of skill-set training that was provided for new telco apprentices and engineers, they spent a lot of money on those good practice[s] and then if people from environment then came into a private company like Vodacom.* (Participant 5 – 4.69)

Government and private sector should collaborate in developing education and skills. Incubation centres are proposed for start-ups.

> *But what happens is I think there is a lot of work that's being done, you've heard of incubation universities. In fact, every university now have incubation centres where you go and you bring your start-up and you get it going.* (Participant 6 – 5.40).

Participants also provided insight regarding the current state of start-ups and how the situation can be remedied.

> *in fact, a lot of companies don't thrive because either there is no demand for what they're doing or they just become redundant because they get copied.* (Participant 6 – 5.40)

*S*pecialisation is emphasised as a requirement for start-ups to survive and be successful.

> *And it's because they're just no good, we're just pushing quantity instead of quality and I believe in quality start-up, rather have a few that thrive and no one will ever copy them and they thrive forever.* (Participant 6 – 5.41)

Government can assist start-ups with macro policies.

> *I'd rather say the best way to do it is to set up in a niche area in our country where we say we're good at this, concentrate our start-ups. If you talk about*

start-ups around that area, be good at that and have the government protecting us with macro policies, internal and external. (Participant 6 – 5.40)

Government should encourage training institutions such as coding schools. This will allow matriculants who failed to get into tertiary education to develop a career path as computer programmers. It will bring down the cost of ICT developers and make ICT development competitive. It would also allow ICT graduates from the tertiary institutions to be productive in a higher layer of ICT. Currently we have a situation where computer science graduates are working as computer programmers at uncompetitive costs.

One participant proposes incentivising companies to go through SETAs (State Educational and Training Authorities), citing the example of Vodacom.

More importantly, it's to create an environment where there's less red tape, but without obviously leaving things too open, like I said, we still need structures that makes sure things are flowing. I think better incentives as well. I will go back to my previous point, if you incentivise as Vodacom through SETA and all these. If you incentivise Vodacom on the basis of how many undergraduates or masters did Vodacom produce, of course that's what you're going to get. (Participant 4 – 3.27)

Participants feel the private sector can play a major role in education and training.

For skilling, the government can do a lot in the universities, you know, in some cases affordable education, but government doesn't have the tax base to do that, so I think private industry needs to play a larger role as well in that. So access to be able to skill up, the biggest challenge is our school education. I mean the whole education system has fallen down to nearly nothing. (Participant 5 – 4.35)

It also means government will have to accept its failures and get private sector assistance.

> *And I think for me, that's where we need to start and the government needs to have the confidence to say: "Guys we've got unique problems, we've got skills, we've got a whole lot of army of people we can turn into coders. They don't have to go to university, they can be given coding lessons and run wild." And learning how to use Blockchain to start tracking expenditure of project.* (Participant 7 – 10.49)

Referring to South African entrepreneurs such as Elon Musk doing well with Tesla, one participant queries the overseas angle.

> *You must then ask yourselves the question: "Why did he go and do it there and not here?"* (Participant 12 – 12.36)

Lack of consistent policies in many areas and constant changes to regulations are concerning. Mining charter and educational policies are quoted as examples of policies not finalised or changed often.

> *The mining charter is still in the air for the last, I don't know, probably since the days of democracy. So why would you ever want to build a new mine here and not even ICQ? Why would you want to build a new mine here if there is no certainty in that?* (Participant 12 – 12.55)

> *Parking the education issue, the other kind of policy, I am not sure if it is round flexible policy because the problem with the government and flexible policies implies there is uncertainty.* (Participant 12 – 12.54)

The need for consistent and continuing government policies is stressed again.

> *Government changes that regulation on a regular basis. So, if we can just get a set of policies, even if they are maybe not great, but at least it is simple to understand and it is consistently applied by government officials and I mean consistently in terms of even if it takes two months to register your company, at least you know it always takes two months. It does not sometimes take two days and sometimes take two years.* (Participant 12 – 12.56)

Some participants believe government has plans but fails in implementation.

> *…just getting implementation on their policy. They have put down great plans in the past, in terms of trying to do economic turnarounds, but we never ever seem to be able to do anything. We cannot get implementation going.* (Participant 12 – 12.58)

ICT decision makers in government appear to have little knowledge of the ICT industry, claim participants.

> *We have decision makers who are politicians instead of having decision makers who are experienced and who are subject masters in those fields. We need people who have been there, done that, to be the decision makers and I don't think our country is at that. We have got policymakers who haven't been through the pain of being IT/ ICT professionals.* (Participant 3 – 2.33)

> *Do you think we have people in government who really understand technology?* (Participant 7 – 10.48)

Government funding is necessary to make the ICT industry competitive. The role of the government in actively supporting the ICT industry is emphasised, using examples from other countries on the continent.

> *I would say that the government's role is very telling. In Safaricom, the Kenyan Government has a stake, so it's highly vested in the success of Safaricom. But the Kenyan Government has also actively supported the ICT industry, so the role of government is quite key in Kenya in promoting the growth of the Kenyan ICT industry. In Rwanda, ever more so, I think it is very visible, even the president himself supporting. They have partnered with some of the biggest global players in this space, but they have also allowed their own players to thrive*. (Participant 8 – 9.62)

Rwanda is considered a prime example of government policy and intervention.

> *So I think that government policy and government intervention and government funding in Rwanda was probably the best of the three countries in terms of the*

intervention, which is why you see the results that you see. (Participant 8 – 9.63)

Some participants recall how, during the apartheid era, government funded the ICT industry to fight international sanctions.

I mean when it comes to skilling-up, so government need to put policies in place which allow for the flow of money in more sensible ways. (Participant 5 – 4.58)

So, what I was saying is that during the apartheid days, in our isolation the government had to dedicate lots of resources, funding, and also you know, develop our sectors – when it came to energy, or Sasol as you mentioned, whether it came to mining, or even whether it came to defence. (Participant 2 – 6.18)

During the apartheid era, South Africa became self-contained as a result of fighting back against sanctions.

They've got a very good head start, you know, because the way the government had to run things – I mean, South Africa is basically self-contained. (Participant 2 – 6.19)

The need to support start-ups and entrepreneurs is emphasised again.

And the government had to, you know, spend lots of resources, especially money into developing all of these companies. But since, obviously you know, with the fall of apartheid, I think the economy took a very different turn; I think the government obviously put a lot of emphasis on trying to bring the poor, address the inequality gap, address the unemployment gap, and we probably took our eye off the ball when it came to us developing our strategic sectors, in that regard. (Participant 2- 6.20)

MTN and Vodacom – if they went out into continental Africa, what support did they get from South African Government, you know, from our local sectors? It was all driven by private capital. (Participant 2 – 6.30)

There is also criticism of the current government's approach to funding.

> *I mean the entrepreneurs who really need the money and can leverage from the money are not the ones who fit the profile of that policy. So money gets thrown after entrepreneurs that quite frankly don't have the hunger, they're like a Garfield the cat sitting in the corner screaming "lasagne, lasagne" and they don't need to move, because Jon keeps on running with the lasagne.* (Participant 5 – 4.59)

> *And especially the ones which tap into some of the SME funding with political transformation quotas, I mean the entrepreneurs are not willing to put the work in, they expect to be spoon-fed, you can't keep on spoon-feeding people.* (Participant 5 – 4.60)

Participants feel government should be proactive in leveraging the intellectual property sitting in academic institutions. Other countries are extensively quoted as examples.

> *The South African Government will take about 51 percent or I think 50 percent of any IP that spin off out of universities into companies. It's a disincentive for investment. Like in Stanford and that, they've got a good model, I know of one South African company at Pretoria University that spun out their IP in a similar model to what Stanford is using and, you know, they're able to grow in scale and able to attract other funding now globally. That's one good example, but there is so much more that can be done, you know, look at the success of the Finnish Government who are spinning IPs out of universities*. (Participant 5 – 4.62)

> *Well, if you look at both these examples that you've mentioned, where did they start? They started from government-sponsored research programmes, right? So a lot of that base has fallen away now in South Africa.* (Participant 5 – 4.67)

Participants gave examples in the past where government-funded research and development programmes facilitated the industry.

There are government research labs like the CSIR, like others who developed some of this IP and then the companies got spun out. And so with even Sasol, there was a government incentive to look at de-risking from petrol and how to do our own production. So this is where Sasol started and then that worked with putting it with the creating that organisation and building them up from the ground up with very innovative people. I mean if you look at Vodacom. Vodacom started, spun out of the monopoly. (Participant 5 – 4.68)

Government's involvement in running SOEs is detrimental to the development of the ICT industry.

There has to be government involvement, there has to be strategic thinking in terms of developing all of these things. (Participant 2 – 6.31)

I mean, government should rather be involved in policies, they should rather be involved in support structures in the technology sector – and let private enterprise run itself. Not try and run companies – I mean, government to me is not very good at running high-tech companies. (Participant 2 – 6.34)

Can we not just look at what China is doing and see how we do similar types of things to encourage local developmental things? It should be like the current BEEE where somebody will say: "No you've got to have 50 percent of the…" It needs to be genuine to say. (Participant 7 – 10.50)

Participants feel government should fast-track IoT and other emerging technologies in state-owned enterprises such as Eskom and Transnet to make the South African ICT industry competitive.

Because imagine if you say, you know, everything that you do at Transnet, everything that you do at Eskom, the IoT angle, Transnet… I mean there's many technologies that can be applied in that space. So if the government attitude in the departments that drive policy and regulation in this space really, really push for ICT, it means that more and more South African ICT companies will be competitive, but I really think the big catalyst has to be the government itself. (Participant 8 – 9.78)

Denel is working on a project designing an aircraft module or a drone for the UAE. They need to be saying deliberately: "We need to have potential to be able to manufacture some of the components locally using our own design capabilities", because I do think we have those types of resources. We can be looking at our own local engineers to be participants in those projects. (Participant 7 – 10.51)

Participants also offer other holistic approaches for the government to consider.

I think total cost promotion in my view. (Participant 13 – 16.60)

When it's a strategically difference in like cost ownership, and why I'm saying that is, let me tell you – I think the strategy, I… technical skills in the country, I'm trying to boost this sector basically by empowering the foreign talent in South Africa – work here and deliver the things. And empower the local young minds. Somehow I feel that, you know, it has to be done of objective, or recent changes need to be adopted, which are happening across the globe, whereas – whereas already we have a huge generation who is unemployed – who is not able to get a good quality education. (Participant 13 – 16.61)

5.5. Conclusion

In this chapter, both the main research question and secondary research questions related to strategically valuable resources (SVRs) have been answered. All the research questions are thus answered in chapters 4 and 5.

The main finding from this chapter is that a framework of SVRs is required to make the South African ICT industry competitive overall in the globalised world. Although the majority are internal SVRs, government policies and funding are external factors that are country-specific SVRs needed to make the South African ICT industry competitive. This finding and framework are detailed in Chapter 6.

One finding from this chapter is that multinationals in the South African ICT industry have SVRs that make them competitive in South Africa. These SVRs can be internal

or external factors. In addition, they can be country-dependent or company-dependent. Chinese multinationals have work ethics, motivation, supply chain and cost factor as some of the country-dependent SVRs. Indian multinationals have work ethics, education, cost factors, techno-functional skills and fixed contracts among their country-dependent SVRs. Similarly, Western multinationals have skills, patents and international resources as some of their country-dependent SVRs. But the most important external factors for multinationals are government policies and support in the form of funding.

Another finding from this chapter is that the South African ICT service sector currently has SVRs such as project management, delivery, mobile services, processes, multiple skills, multi-tasking and quality. However, these are historically inherited SVRs. In addition, they are internal factors. External factors such as government policies and support are not present as SVRs.

Chapter 6: Theoretical Framework

6.1. Emergent theoretical framework

6.1.1. Introduction

Inductive coding was used (Fereday & Muir-Cochrane, 2006) in the preceding chapters. This was done as the researcher approached the interview process with an open mind and conducted exploratory and heuristic research on the South African ICT industry. Only limited literature is available dealing with the South African ICT industry. At the same time, thematic analysis of the literature on ICT multinationals in South Africa allowed the researcher to develop an initial prototype codebook. This codebook evolved during the interview process and subsequent analysis.

Interview data was scrutinised using content analysis. There are three approaches to content analysis (Hsieh & Shannon, 2005). The direct content analysis approach is used here as the study is developing an existing theory in the form of an enhanced resource-based view.

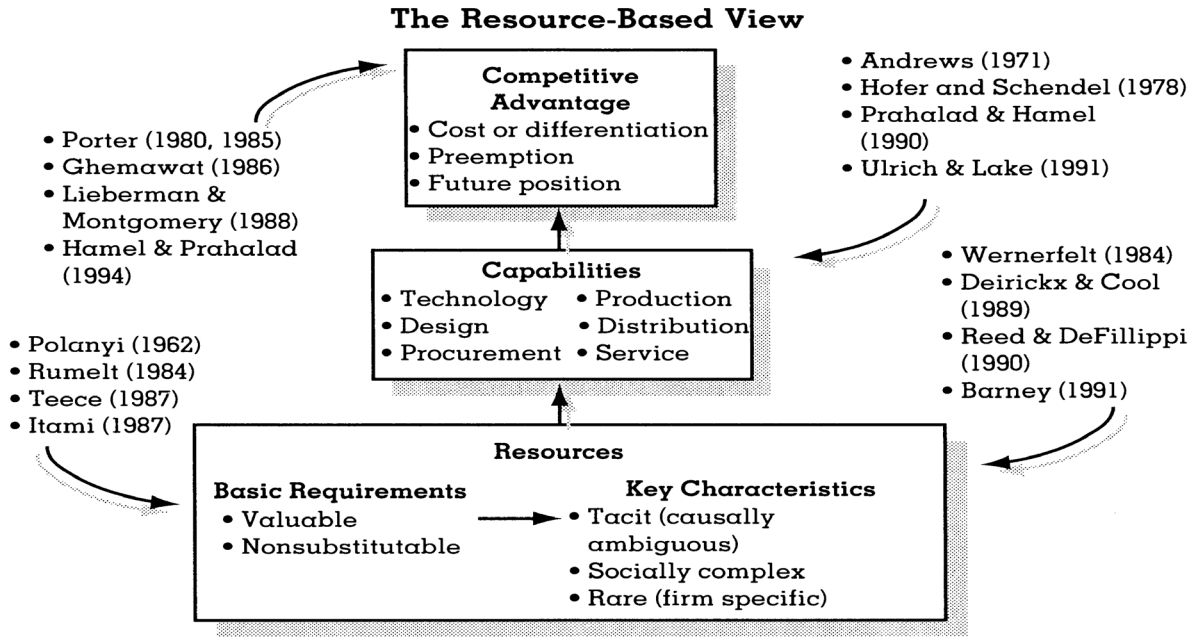
All results from the interviews were interpreted in an unbiased and impartial manner in accordance with the basic tenets of grounded theory. Information obtained from the interviews was analysed to link it to the research problem and research questions. Concepts and theories were developed from the data through a stringent process of comparing ideas with existing data, then improving the emerging concepts and theories against the new data collected specifically for that purpose.

The emerging theories that represent this study's major contribution are analysed here before the chapter concludes with the key findings and emerging conceptual framework.

6.1.2. Enhanced resource-based view

The enhanced RBV is the existing ground-level theory, as discussed in the literature review. Both internal and external factors are crucial to competitive success (Fiegenbaum et al., 1996; Hansen & Wernerfelt, 1989).

Figure 15: Enhanced resource-based view



Source: S. L. Hart (1995).

This study builds the enhanced resource-based view from a single company to an industry, namely the ICT industry in South Africa. In this way the competitiveness of the South African ICT industry as against multinationals operating in South Africa is determined. The study also determines the strategically valuable resources (SVRs) required to make the South African ICT industry competitive overall.

In this study, the enhanced resource-based view is developed from a single company to an industry and to a specific country. Multinationals – specifically Chinese and Indian multinationals in the ICT industry – have country-specific SVRs that make their companies competitive in a third country. The study also shows there are country-specific SVRs that can make the ICT industry in South Africa competitive against

multinationals. Ground-based enhanced resource-based review is developed into a theory applicable to a country and a specific industry. In addition, the study shows that SVRs in a sector of ICT can be applicable to the ICT industry as a whole.

6.1.3. Historic strategically valuable resources (SVRs)

During the apartheid era the South African ICT industry was competitive, especially in the high-technology sector. Although many multinationals did not operate in the country because of international sanctions, South African ICT companies fared well in the export market against multinationals. The competitiveness of South Africa's ICT industry was enabled by the SVRs it possessed. Table 8 below lists the country's historic SVRs.

Table 7: Historic strategically valuable resources (SVRs)

Strategically valuable resources (SVRs)	**Sector**
Project Management	All sectors
Niche skills	All sectors, specifically state-owned enterprises
Creativity and innovation	All sectors
Processes	All sectors
Multiskilling	All sectors
Multitasking	All sectors
IP (intellectual property)	Academic/government-run research
Management	All sectors

Strategically valuable resources (SVRs)	**Sector**
Government funding	All sectors
Government policies	All sectors
Work attitude	All sectors

Source: Author's construction.

6.1.4. Current strategically valuable resources (SVRs)

Current SVRs of South Africa's ICT industry make the country's ICT service sector competitive. ICT services exist in every economic sector of the country. Some strategically valuable resources (SVRs) were inherited from the historically competitive South African ICT industry. These are delivery, project management, creativity and innovation, processes, multitasking and multiskilling. In addition, South Africa's ICT sector has its own SVRs such as mobile services, brands, intellectual property, entrepreneurs, management, and knowledge and work attitude.

Current SVRs in the South African ICT industry have made the country's ICT service sector competitive in telecommunications, broadcasting and banking. Because of the competitiveness of the ICT service sector, telecommunications providers such as Vodacom and MTN are globally competitive. Similarly, the competitiveness of the ICT service sector has made broadcasting services such as MultiChoice globally competitive. The competitiveness of the ICT service sector has made the South African banking sector globally competitive. Banks are providing FinTech services. Two of the biggest banks in country are also virtual mobile network operators (MVNOs). All the country's big banks provide mobile services such as mobile apps to carry out banking functions. In addition, banks use emerging technologies such as automation, artificial intelligence and big data as SVRs. Rapid transition from Internet banking to mobile banking, especially during the Covid-19 pandemic, has made the

South African banking sector highly competitive, globally. ICT services have also made high-technology companies such as Sasol, Denel and SAB competitive.

Although current SVRs are internal to a firm or industry, government policies – such as asymmetric interconnect charges, and Telkom providing free infrastructure to Vodacom at the inception of Vodacom – can be considered as external SVRs.

Table 8: Current strategically valuable resources (SVRs)

Strategically valuable resources (SVRs)	**Sector**
Project Management	ICT service sector
Mobile services	ICT service sector
Creativity and innovation	All sectors
Processes	ICT service sector
Multiskilling	ICT service sector
Multitasking	ICT service sector
Brand	ICT service sector
IP (intellectual property)	Academic/government-run research
Management	ICT service sector
Entrepreneur	Start-ups
FinTech services	Banking, Mobile in future
Work attitude	ICT service sector

Source: Author's construction.

6.1.5. Current applicable emerging technologies in SA

Some of the 40 emerging technologies of the 4IR are already in use in South Africa. Table 10 below lists the technologies and sectors using these technologies.

Table 9: Current applicable emerging technologies in South Africa

Emerging technology	**Sector**
Mobile banking/money	Banking/mobile
Blockchain	Banking sector
Big data	Banking sector
Drones	Mining sector, security service
Location-based system	Mobile operations, Covid-19 contact tracing
IoT	ICT service sector
Renewal energy products	Energy sector
Hyperautomation	All sectors
Total experience	All sectors

Source: Author's construction.

6.1.6. Strategically valuable resources (SVRs) of multinationals operating in SA

Western, Chinese and Indian multinationals are currently operating in the South African ICT industry. Western multinationals have been operating for a long period in South Africa. Chinese and Indian multinationals are recent entrants to the South African ICT industry. These multinationals have few SVRs in common. However, the SVRs of these multinationals make them competitive.

Table 10: Company-specific strategically valuable resources of multinationals

ICT Multinational	Strategically valuable resources (SVRs)
Huawei, ZTE	Research and development, capital financing. Quality, cost factor, work ethics, technological innovation, knowledge sharing, economies of scale.
Kansar, TCS	Software development, work ethics, technological innovation, higher value-added services, research and development, management style, planned opportunism and cost factor, knowledge sharing, economies of scale.
Intel	Platform leadership, architecture leadership. Pool of research facilities around the world, economies of scale.
Cisco	Platform leadership, network standards leadership, economies of scale.
Apple	Innovation, products, economies of scale.
IBM	High-end hardware, economies of scale.
Ericsson	Product diversification. Adoption of emerging technology (cloud computing), economies of scale.

Source: Author's construction.

The countries from which these multinationals originate have their country-specific SVRs. Multinationals leverage their own country-specific SVRs to gain competitive advantage over multinationals from other countries. This is in addition to their own firm-specific SVRs.

Table 11: Country-specific strategically valuable resources (SVRs)

Countries	**Strategically valuable resources (SVRs)**
China	Work ethics, culture, abundance of graduates, supply chain, government funding, government support, cost factor, research and development, adoption of emerging technologies.
India	Software development, work ethics, abundance of graduates, research and development, cost factor, techno-functional capabilities, fixed contracts, management style, planned opportunism, work ethics, government support, adoption of emerging technologies.
US	Platform leadership, architecture leadership. Pool of research facilities around the world, innovation, new products, total cost optimisation, adoption of emerging technologies.
Western Europe	Product diversification. Adoption of emerging technology (cloud computing), total cost optimisation.

Source: Author's construction.

Some of the strategically valuable resources (SVRs) listed above can be adapted to South African conditions and are listed in Table 13 below.

Table 12: Adaptable strategically valuable resources from ICT multinationals

Countries	Strategically valuable resources (SVRs)
China	Research and development, government funding, adoption of emerging technologies
India	Research and development, technofunctional capabilities, fixed contracts, government support, adoption of emerging technologies.
US	Innovation, new products, total cost optimisation, adoption of emerging technologies.
Western Europe	Adoption of emerging technologies (cloud computing), total cost optimisation.

Source: Author's construction.

6.1.7. Government policies, regulations and funding

Government policies and regulations are currently not oriented towards a competitive ICT industry. Stimulus actions are necessary to achieve a competitive ICT industry. In addition, government funding is required in many areas, especially for start-ups. Interviews with the participants clearly show that government needs to deploy stimulus actions to make the South African ICT industry competitive. Table 14 below lists the required stimulus actions.

Table 13: Government policies, regulations and funding

Government stimulus actions	Specific activities
Funding	Funding for start-ups, entrepreneurs, research and development.
Regulations to control multinationals	Encouragement for manufacturing investment and control service sector investment.
Speedy spectrum allocation	Mobile industry can increase network coverage.
Low-cost data	Government to regulate data costs stringently.
ICT-focused education	Coding schools, incubation centres.
IoT implementation in SOEs	Specifically at Eskom, Transnet.
ICT-competent government decision makers	ICT policy decision makers to be ICT-competent.
Revision of BEEE policies that impact the competitiveness of South Africa's ICT Industry	BEEE policies impacting niche skills, brain drain and competitiveness to be revised.
Government coordination of academic and private sectors to leverage IP	Government drives the use of IP in the academic world. Similar to Nedlac.
Consistent ICT policies	Long-term polices that will make South Africa's ICT industry competitive.

Government stimulus actions	Specific activities
Government policies to encourage mobile money such as electronic wallets.	COVID-19 has already increased the use of mobile banking. FinTech services will benefit.

Source: Author's construction.

6.1.8. Required strategically valuable resources (SVRs) for South Africa's ICT industry

Required SVRs are a combination of existing SVRs in the competitive South African ICT service sector and SVRs recommended by participants. The SVRs identified by participants include emerging technologies, government policies and government funding. These required SVRs can make the South African ICT industry competitive. Table 15 below provides a list of required SVRs.

Table 14: Required strategically valuable resources (SVRs)

Strategically valuable resource	Applicable sectors
IoT	State-owned entry services such as Eskom, Transnet. Other services such as vehicle tracking, logistics.
Hyperautomation of processes	Emerging technology in all sectors.
Project Management	In all sectors, current SVR in ICT service sector.
Blockchain	Emerging technology in banking, mining sectors.

Strategically valuable resource	**Applicable sectors**
Delivery	In all sectors, current SVR in ICT service sector.
Creativity and innovations	Start-ups, entrepreneurs.
Research and Development	In all sectors.
IP (intellectual property)	Universities, industry.
Call centres	All sectors. Call centres set up for internal customers or subscribers can also be used to provide service to foreign customers or subscribers to bring added value to the company.
Mobile services including location-based systems	In all sectors, current SVR in the ICT service sector. It is also an emerging technology.
Affordable ICT development skills with overall cost optimisation	All sectors.
FinTech services	Banking and Mobile sectors.
Government funding adapted to South African requirements	All sectors.
Techno-functional skills	All sectors. Adapted from multinationals. There are already unrecognised techno-functional skills in the ICT industry.
Stimulating government policies and regulations adapted to South African requirements.	All sectors.

Strategically valuable resource	**Applicable sectors**
Drones	All sectors. Emerging technology.
Low-cost data	All sectors.
Network coverage	All sectors.
Quality	Total quality management In all sectors, current SVR in ICT service sector.
System integration	In all sectors, current SVR in ICT service sector.
Cyber security	In all sectors, current SVR in ICT service sector.
Collaboration with multinationals to develop or manufacture parts or components	ICT manufacturing, ICT development.
Total experience	ICT service sector.

Source: Author's construction.

Artificial intelligence and machine learning are two other possible SVRs. However, developers in these fields are scarce in South Africa. However, changing the overall ICT recruitment strategy will alleviate this problem. Low-cost entrant programmers can be recruited from coding schools. Higher-cost developers of artificial intelligence, machine learning and Blockchain can then be recruited from tertiary institutions. This will create an abundant pool of resources and total cost optimisation.

Some economists believe automation and the adoption of artificial intelligence will lead to job losses among blue-collar workers. However, the fact remains that the world is moving towards automation and the adoption of AI. By developing these capabilities

internally, South Africa can create jobs rather than depend on importing the technologies.

In addition, the long-term goal of artificial intelligence (AI) is to make machines learn and think like human beings. However, owing to the high levels of uncertainty and vulnerability in human life and the open-ended nature of problems that humans are facing, no matter how intelligent machines are, they are unable to completely replace humans (Zheng et al., 2017). Therefore, it is necessary to introduce human cognitive capabilities or human-like cognitive models into AI systems to develop a new form of AI, that is, hybrid-augmented intelligence. This form of AI or machine intelligence is a feasible and important developing model. Hybrid-augmented intelligence can be divided into two basic models: one is human-in-the-loop augmented intelligence with human-computer collaboration, and the other is cognitive computing-based augmented intelligence, in which a cognitive model is embedded in the machine learning system (Zheng et al., 2017). In hindsight, the fourth industrial revolution is not about just automation. As augmented intelligence shows, there is a need to integrate human intelligence and artificial intelligence. South Africa, like China where there is an abundance of human labour, can follow this field as a SVR.

The ICT industry is heterogeneous. Each ICT firm or company will have its own SVRs to be chosen from the above framework of required SVRs to be competitive.

6.1.9. Overall cost optimisation in South African ICT development

One major SVR of the ICT multinationals operating in South Africa is the cost factor. Both China and India have comparatively low-cost developers and analysts. US and European multinationals blend high-cost resources from their own countries with low-cost ICT development resources from Third World countries. In order to be competitive in regard to costs, South Africa has to develop a model for cost optimisation.

At the bottom of the pyramid are the low-cost ICT programmers who are trained in coding schools. They are mostly matriculants and as such, comparatively less expensive than graduates from tertiary institutions. They are also comparatively inexperienced and are new entrants to the ICT industry. They will be an abundant

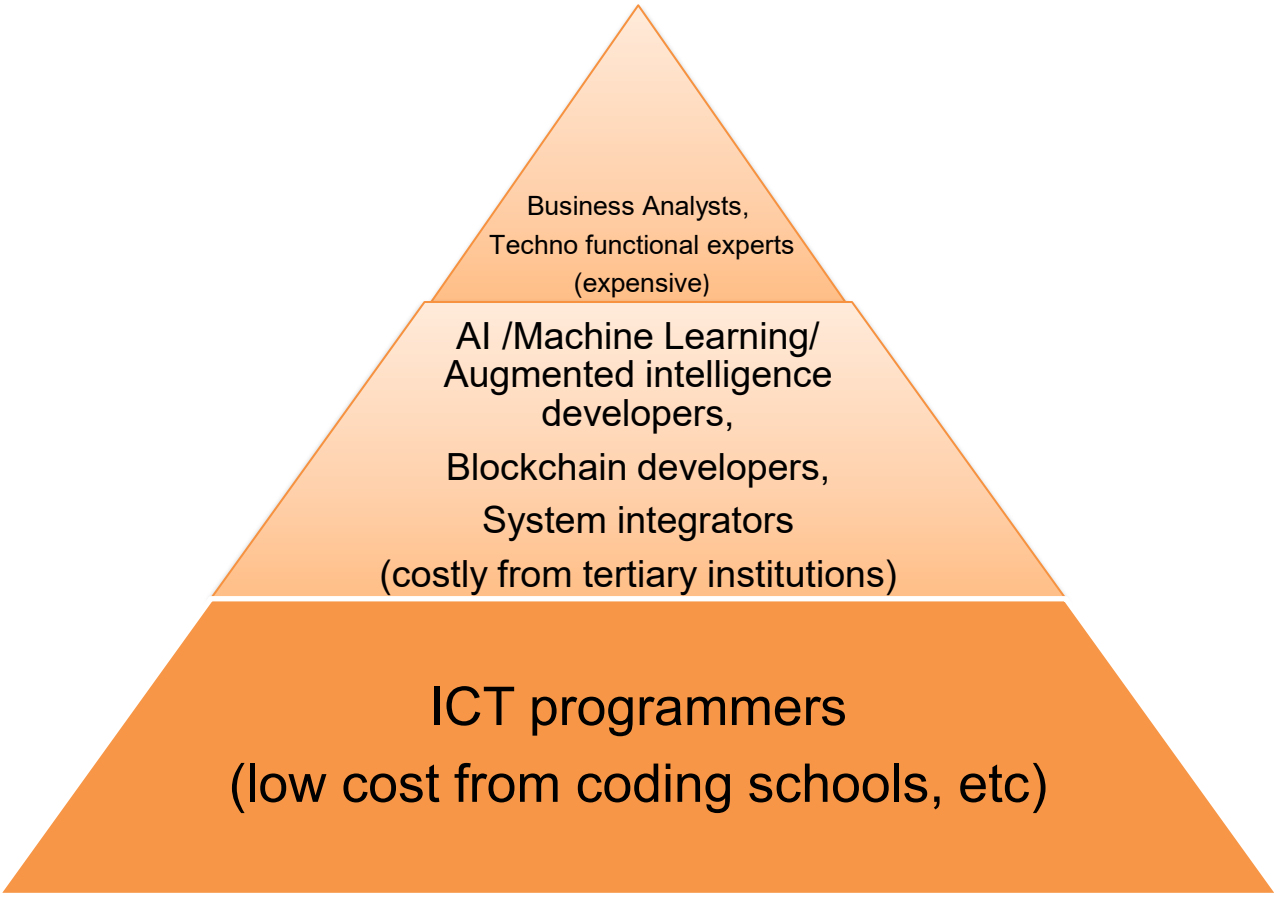
resource and the least expensive one. But they also form the largest segment of ICT resources, who can develop Java, web applications, mobile applications and other low-level programming applications.

In the middle of the pyramid are AI/Machine learning developers, augmented intelligence developers and system integrators. They are from tertiary institutions and are costly. Although they are a scarce resource, they are not required in large numbers as is the lower segment. Tertiary institutions that are running computer science and IT degree-level programmes can produce graduates to fit into the middle layer of ICT skills as AI, machine learning and Blockchain development as well as system integration. These job categories are costly compared to the bottom layer ones. Currently, university graduates are doing programming work as South Africa lacks sufficient programmers. If coding schools and similar training schools can produce programmers, then the university graduates can undertake higher-level work. At the highest level, the career path is open to them becoming well-paid business analysts and technofunctional experts.

Finally at the top of the pyramid are the business analysts and technofunctional experts. They are highly experienced and expensive and form the main link between the business and ICT in any ICT company. They understand the business and the role of the ICT in the ICT industry.

Blending the ICT resources as described above will make South Africa’s ICT industry competitive in terms of costs. This is depicted in Figure 17 below.

Figure 16: Framework of ICT development skills with overall cost optimisation



Source: Author's construction

By blending the resources from different segments, the ICT industry can optimise costs and compete with multinationals. In addition, by providing total quality management in their work, South African resources can be more competitive than resources from the host countries of multinationals.

Quality is an important contributory factor in cost optimisation. If development work has to be repeated to rectify issues or bugs, it adds to the cost. Getting it right first time provides competitive advantage.

6.1.10. Emergent theoretical framework

A theory is a set of inter-related concepts, which structure a systematic view of a phenomena for the purpose of explaining or predicting (Liehr & Smith, 1999). A theory is like a blueprint.

Figure 18 below represents the theoretical model for an enhanced resource-based view for the ICT industry encompassing all the themes analysed in chapters 4 and 5 and the associated theoretical dimensions drawn from the enhanced resource-based view. Analysis of the data collected in the interview process revealed new and interrelated concepts that should be included in the theory.

New interrelated concepts are as follows:

Firstly, there are current strategically valuable resources (SVRs) which make the South African ICT service sector competitive. Some of these are historically inherited SVRs. These can contribute to the required SVRs to make the South African ICT industry competitive.

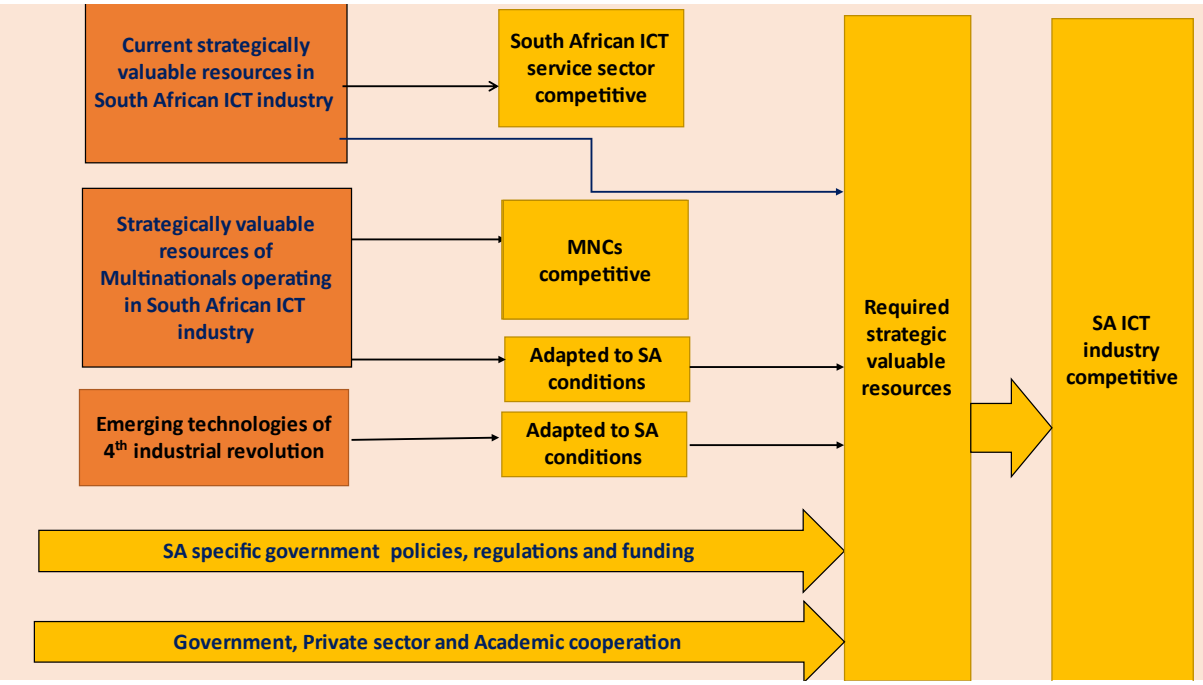
Secondly, SVRs of multinationals operating in the South African ICT industry make the MNCs competitive in South Africa. Some of these variables are government funding and government policies, government academic and private sector cooperation. These SVRs can be adapted in different forms as required SVRs to make the South African ICT industry competitive. In addition, there are SVRs such as total cost optimization and techno-functional skills which can be adapted as required SVRs for the South African ICT industry. There are also other SVRs that are unique to the host countries.

Thirdly, emerging technologies of the Fourth Industrial Revolution (4IR) which are adapted to South African conditions can be leveraged to provide the required SVRs in the technology space to make South African ICT industry competitive.

Finally, deriving from the SVRs of the multinationals operating in South Africa, government funding and government policies, government academic and private

sector cooperation are SVRs that can make the South African ICT industry competitive.

Figure 17: Theoretical framework for South African ICT industry competitiveness



Source: Author's construction.

6.2. Conclusion

The findings of this study indicated that South Africa's ICT industry is only competitive within the country's own ICT service sector. Even in the case of the South African ICT service sector, it is still dependent on multinationals in the ICT industry for many elements. The study also confirms that historically, the South African ICT industry was competitive as a result of strategically valuable resources (SVRs) developing following government intervention. In addition, the study confirms that some of these historic SVRs were inherited mainly by the ICT service sector.

Evidence developed in the course of this study also confirms there are SVR frameworks that can make South Africa's ICT industry competitive. These SVRs are derived from current SVRs in the ICT service sector, applicable emerging

technologies, government intervention and from adaption of the SVRs of multinationals operating in South Africa.

Study of the multinationals operating in South Africa also shows there are country-wide SVRs that make the originating country competitive.

The next, and concluding, chapter presents the contributions of this study, considers any limitations, and offers recommendations for future research.

Chapter 7: FINDINGS AND CONCLUSIONS

7.1. Introduction

This research set out to examine the competitiveness of South Africa's ICT industry, together with the competitiveness of multinationals operating in the South African ICT industry, and then to determine the strategically valuable resources (SVRs) required to make the South African ICT industry globally competitive. Having analysed and discussed the findings as reflected in chapters 4 to 6, this chapter provides a summary of the main conclusions. Section 7.2. Demonstrates that the objectives of the research were attained in the main conclusions. Section 7.3. Highlights the study's original contributions to the body of knowledge. Section 7.4. Discusses the limitations and offers suggestions for future research.

7.2. Summary of main findings

The main conclusions drawn from this research are presented in this section and are aimed at answering the primary and secondary questions. The analysis here will not replicate issues covered in previous chapters but will summarise the main points and refer to the relevant sections for more details.

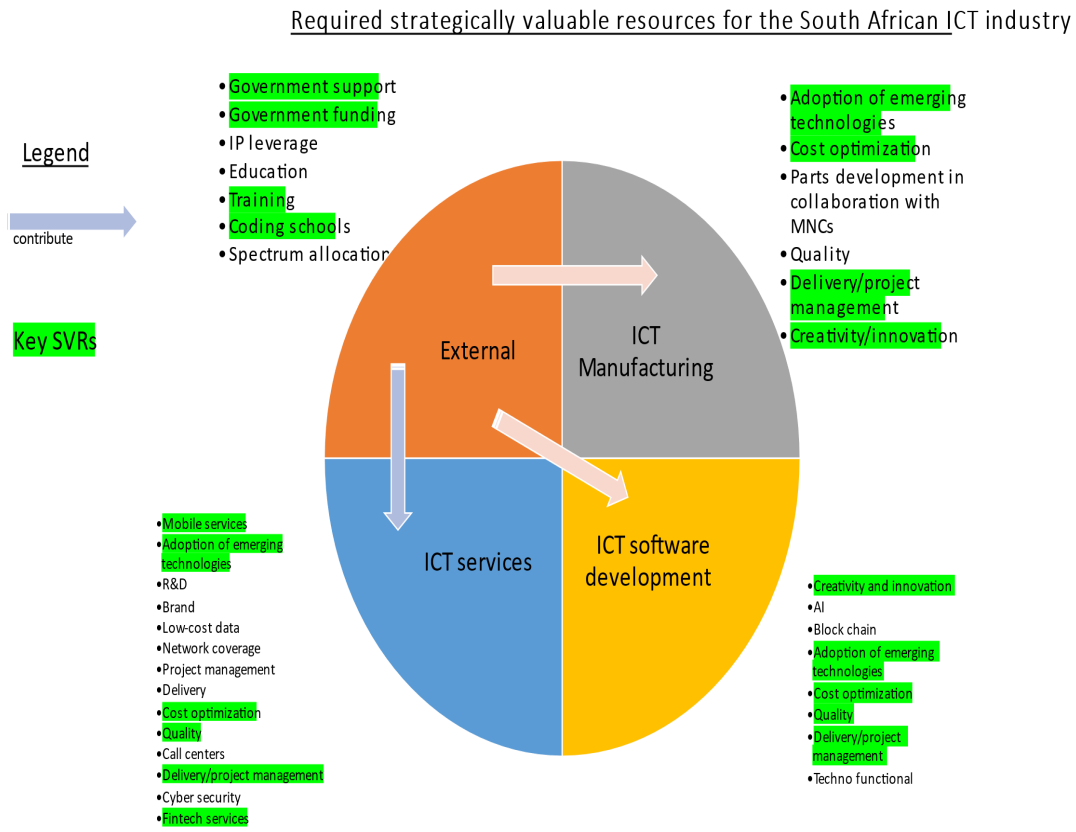
The conclusions arrived at are as follows:

7.2.1. Answering the primary research question

What strategically valuable resources (SVRs) are required by South African ICT companies to develop global competitiveness of the South African ICT industry?

A framework of the SVRs required by South African ICT companies to develop the global competitiveness of the South African ICT industry was determined earlier in Chapter 5.

Figure 18: Framework of required strategically valuable resources (SVRs)



Source: Author's construction.

The framework in Figure 19 above depicts SVRs for the South African ICT industry. The ICT industry is segmented into three sectors: ICT manufacturing, which is primarily hardware and parts; ICT software development, which includes emerging technologies development and deployment; and ICT services such as telecommunications, broadcasting services and satellite services. Individual ICT firms can adopt SVRs from this framework. Individual ICT firms can also adopt one or more specific technologies from the plethora of emerging technologies to set their own SVRs. A single emerging technology on its own may not be an SVR standing alone, as multinationals may be already applying or selling the products of that emerging technology. The strategic value of a single emerging technology lies in its business application and products. For example, artificial intelligence can be applied literally in every type of business. Similarly, nano technology can be applied across the range from satellites to medicines.

Important examples of emerging technologies are IoT, hyperautomation of processes, artificial intelligence (AI), drones, nano technologies, quantum technologies, cloud computing, big data, renewable energy, electric vehicles, drones and blockchain.

Hyper automation of processes includes robotic processes. Although hyper automation could lead to job losses with the use of robots, other jobs can be generated such as robot operators, robot maintenance and robot manufacturing. Robots have also been used in situations where human beings cannot interact, such as dealing with patients in a pandemic situation. Hyper automation is a business-driven effort based on quality improvement, time-to-market and other factors. Opportunities from the hyper automation of processes can become SVRs for South African ICT companies.

Artificial intelligence is becoming applicable in every type of business. Today multinationals like Amazon deploy AI in their core businesses such as retail, marketing, supply chain, etc., to remain competitive. Artificial intelligence requires firms to develop, maintain and support AI applications. Specialised programming knowledge of programming languages such as Python are required. These programming languages can be taught in tertiary institutions.

Involvement of the IoT is becoming imperative in state-owned enterprises such as Eskom. As Eskom tries to integrate its traditional coal-based plants with decentralised multi-supplier renewal energy platforms, the IoT can become critical for the seamless supply of energy to local and foreign customers (Raj, 2021). This in turn creates opportunities for IoT equipment and parts manufacturers, IoT software developers, AI developers and service providers such as those involved with 5G and fibre service.

Blockchain is utilised in the financial and mining sectors. Blockchain is used in crypto currencies such as Bitcoin in the financial sector. In addition, Blockchain is used for complex asset management in mines. However, Blockchain can be used for further opportunities in South African ICT industry. It can be the driving force for many ICT start-ups with its secure technology and can be used for smart contracts and asset management. Blockchain requires developers, solution architects and operations staff.

Drone technology is widely used around the world. It is becoming an essential component of hybrid and asymmetrical warfare. Drones have been used for mapping and surveillance in South Africa. Drone technology requires operators, programmers and maintenance staff. Manufacturers and parts suppliers are needed. A start-up can easily carry out drone operations for many sectors of the economy.

Nanotechnologies are applied to satellites, plus the health and other sectors. In the health sector, nanotechnology is used for COVID-19 vaccine research, specifically in the case of mRNA vaccines (Chung, Beiss, Fiering, & Steinmetz, 2020).

Quantum computing is another emerging technology. Quantum computers are developed in the US and elsewhere. There are opportunities for research and development in South Africa.

Electric vehicles are still expensive in South Africa. Efforts to make electric vehicles affordable could present opportunities for the South African ICT industry.

Emerging technologies come with their own drawbacks. As discussed earlier, artificial intelligence has its own threshold and augmented intelligence comes in as a new technology. Similarly, quantum computing is a serious threat to existing encryption algorithms and cyber security as quantum computers can break existing encryption. One important emerging technology is 5G, which is the data backbone of many emerging technologies. However the US Federal Aviation Authority (FFA) has expressed concern in its Notices to Airmen (NOTAM) about potential disruptions to flights (FAA, 2022). Subsequently, major airlines suspended flights to certain US cities. The actual issue is related to the spectrum allocation of extreme range in the C-band to major US telecom operators. Operators in the US has been allocated the 3.7-3.98 GHz frequency (Web, 2022). The aviation industry uses 4.2-4.4 GHz for navigational systems. The industry fears the proximity of these two ranges could present safety issues. This is a major setback to the use of 5G as airports were expected to become smart hubs in the course of the 4IR.

The Connecticut-based Gartner group has produced a roadmap for 111 emerging technologies for 2021-2023. Many of those technologies present opportunities for ICT companies or start-ups.

At present, emerging technologies in South Africa are mainly manufactured or developed abroad and supplied by multinationals to South Africa. Adoption of emerging technologies would mean more dependence on multinationals. The only way to reduce this dependency is to manufacture or develop these emerging technologies in South Africa, initially in collaboration with multinational suppliers. For a start, South African ICT companies or start-ups could manufacture or develop parts or components for multinational-supplied equipment or software applications. These conditions could be included in contracts dealing with imports from multinationals. Government import regulations can facilitate this process.

Implementing and upgrading emerging technologies requires project management and delivery capabilities. In South Africa, project management and delivery are strategically valuable resources (SVRs). Creativity and innovation are also existing SVRs. Vodacom introduced the “please call me” service which has now been adopted around the world. Nanosatellites, launched into space by CPUT, are another example of creativity and innovation. Government has said that South Africa aims to become the nanosatellite leader in Africa (Africa, 2022). Another example is digital Laser which allows for real-time switching in spatial modes (Ngcobo, Litvin, Burger, & Forbes, 2013). Other SVRs such as techno functional skills have been adapted from multinationals. South African ICT professionals already possess techno-functional skills. They have the ability to multitask and play the role of technical specialist while analysing and understanding the business and its requirements.

A significant number of the minerals used in emerging technologies are mined in South Africa. As such there is a case for South Africa to manufacture both the parts and spares for those emerging technologies.

Overall cost optimisation was discussed earlier in section 6.1.9. A model was presented covering overall cost optimisation to compete with multinationals.

Provision of fintech is a growing ICT service in South Africa. However, it has grown even more elsewhere in Africa, particularly in East Africa. With the lack of conventional banking services in the rural areas across Africa, fintech services such as mobile money have become popular. Mobile money was heavily utilised in South Africa during the course of the COVID-19 pandemic. Many low-level cash transactions are done using mobile money instead of cash. Even domestic workers are paid in mobile money which they retrieve from ATMs. However, as participants pointed out, obtaining a banking license is holding back the spread of fintech services.

Government funding and support, which are identified as external SVRs, can take different forms, some of these being unique to South Africa. In China, the government established bodies such as the China Development Bank and EXIM Bank to provide credit to state-owned enterprises (Ru, 2018). In the same way, the South African Government could set up state-owned banks to provide credit for ICT start-ups or to help ICT companies to become competitive. Alternatively, there could be collaboration between government and the private sector. When private banks make home loans to customers, these could include a clause relating to renewable energy or solar energy. This would benefit solar panel suppliers, installers and ultimately the manufacturers of solar energy products. The South African Government recently relaxed energy supply regulations by increasing the threshold for unlicensed power generation from 1 MW to 100 MW (Africa, 2021), a move that is also likely to encourage solar energy producers. Two further areas in which the South African Government could contribute are spectrum allocation and coordination between academic world and private sector in the utilization of available IP.

7.2.2. Answering Secondary *Q*uestion *O*ne

What is the current competitive status of the South African ICT industry?

As depicted in chapters 4 and 6, South Africa's ICT industry is only competitive in the ICT service sector. This primarily comprises mobile operations, broadcasting services and banking services. Even the ICT service sector depends on multinationals for

hardware, software and solutions. Some of the competing companies in the ICT service sector are partly owned by multinationals.

Apart from a few isolated cases, South Africa's ICT industry is not competitive in the ICT manufacturing or software development sectors.

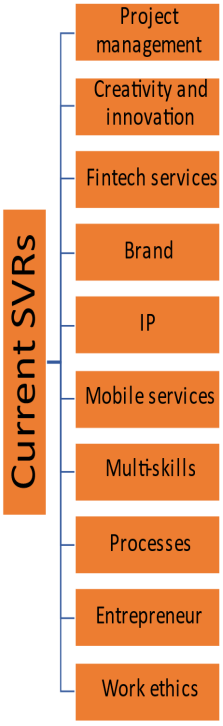
Historically the South African ICT industry was competitive, primarily because of resistance to international sanctions during the apartheid era involving government funding. Many historical SVRs have been carried over to the ICT service sector.

7.2.3. Answering Secondary Question Two

What are the current strategically valuable resources (SVRs) of the South African ICT industry?

Current SVRs of the South African ICT industry were determined in Chapter 5. They are delineated below in Figure 20.

Figure 19: Framework of current strategically valuable resources in the South African ICT industry.



Source: Author's construction

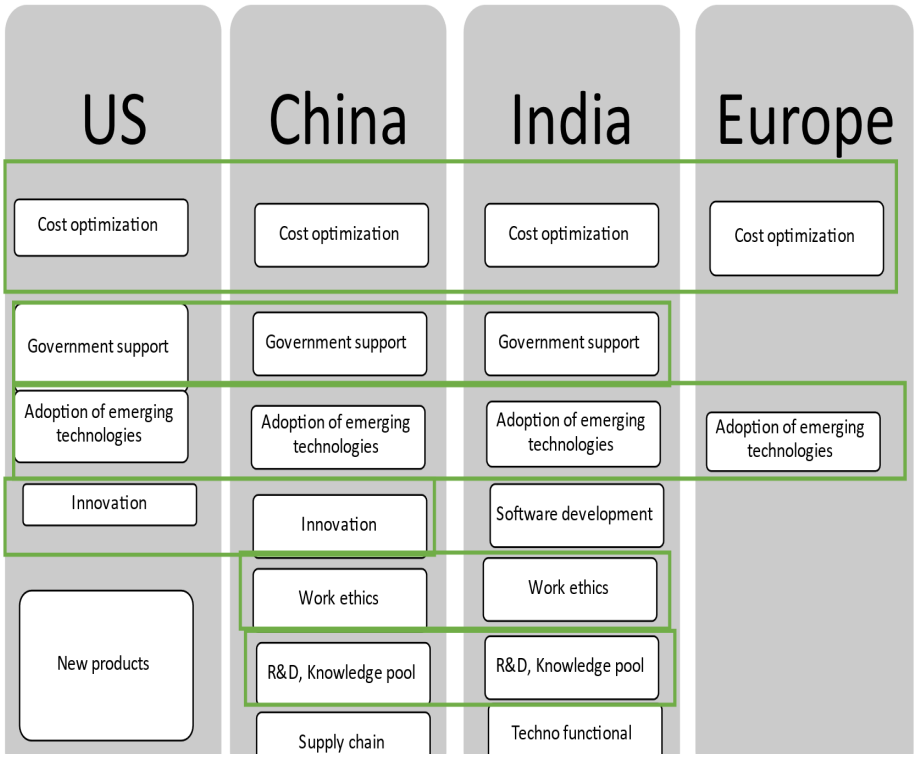
These SVRs are mainly found in the ICT service sector, with many being inherited from the previous apartheid government. Mobile services and FinTech services are recent SVRs, being found mainly in the mobile, banking and broadcasting services.

7.2.4. Answering Secondary Question Three

What are the current strategically valuable resources (SVRs) of the ICT multinationals that are competing with South Africa's ICT industry?

A country-specific framework of current SVRs of ICT multinationals that are competing with South Africa's ICT industry was determined in Chapter 5. This framework (see Figure 21 below) assists ICT multinationals to be competitive in South Africa.

Figure 21: Framework of country-specific strategically valuable resources of ICT multinationals



Source: Author's construction.

Although some SVRs such as cost optimisation are common to multinationals in all four countries, each multinational adapts the cost optimisation in terms of its own requirements, making the SVR unique. All the multinationals blend high- and low-cost ICT resources. During the project implementation phase, mainly high- or medium-cost ICT resources are used on-site. Once the project switches over to the operations phase, low-cost resources such as trainees are used, supported by the available knowledge pool in host countries.

Research and development (R&D) and knowledge pool/sharing are country-specific SVRs for multinationals from China and India. Similarly, R&D is an SVR of Western multinationals. In China and India, knowledge is pooled centrally in host countries. Using Huawei as an example, all the knowledge and experience obtained in China and other countries in added to the knowledge pool in Shenzhen. All the knowledge gained from projects and support operations is pooled centrally. Using artificial

intelligence and other systems, this knowledge pool is used to extract new product models or new technologies.

7.3. Contributions of the study

This research further builds on a conceptual framework of competitiveness. In particular, the resource-based view and specifically, an enhanced resource-based view, are extended to an industry and a country. In addition, this study provides an empirical examination of how SVRs in the South African ICT industry affect the competitiveness of the country's ICT industry.

7.3.1. Theoretical contribution

The theoretical contribution of the study is the identification of the role of ICT competitiveness in economic development in South Africa, as well as the examination of the factors that influence ICT competitiveness in the country. By drawing on the resource-based view and Porter's Five Forces theory, the study contributes to the existing literature on the relationship between ICT and economic development, particularly in the South African context. The study also provides empirical evidence to support the argument that ICT competitiveness plays a crucial role in economic development in South Africa. This finding is consistent with previous studies that have identified the role of ICT in facilitating economic growth and development in developing countries.

Furthermore, the study contributes to the theoretical understanding of the factors that influence ICT competitiveness in South Africa. By analyzing the impact of factors such as government policies, infrastructure, education and training, and innovation, the study highlights the importance of these factors in enhancing ICT competitiveness. Overall, the theoretical contribution of the study lies in its examination of the relationship between ICT competitiveness and economic development in South Africa, and its identification of the key factors that influence ICT competitiveness in the country. These findings can inform policymakers and practitioners in developing

strategies to enhance ICT competitiveness and promote economic development in South Africa.

7.3.2. Empirical contribution

The study shows that the relationship between the competitiveness of a firm and SVRs can be extended to an industry such as ICT in a developing country like South Africa. It is also shown that the success of ICT multinationals in South Africa is related to their own SVRs. Further, government policies in many of the countries from which ICT multinationals originate are linked to the competitiveness of these multinationals. Government policies such as laws, regulations and – most importantly – funding, are conducive to the growth of multinationals and as such are external SVRs of the multinationals. It also becomes clear in the course of the study that there are both internal and external SVRs that are linked to the competitiveness of ICT multinationals operating in South Africa.

A study of the historic competitiveness of South Africa's ICT industry shows that both internal and external SVRs are linked to this former competitiveness. The study also shows that the competitiveness of the South African ICT service sector is related to the SVRs owned by the ICT service sector.

By focusing on competitiveness in the South African ICT industry, this study contributed to the empirical knowledge of ways in which the global competitiveness of an industry or a company can be developed within a country. Participants' experiences provided detailed and valuable empirical data in the form of thick description (Ponterotto, 2006). Participants have all had more than 20 years' experience in the ICT industry as executives or senior managers. The empirical data in the form of thick description, which was obtained from interviews, will provide substantial knowledge to other stakeholders in the South African ICT industry, both in government and the private sector.

7.3.3. Methodological contribution

The methodological contribution of the study lies in its use of a mixed-methods approach to gather and analyze data. The study employed both qualitative and quantitative research methods, which allowed for a comprehensive understanding of the research problem and a triangulation of the findings. The qualitative component of the study involved conducting in-depth interviews with key stakeholders in the ICT industry in South Africa. This approach allowed for a detailed exploration of the perceptions and experiences of the participants regarding ICT competitiveness in the country. The qualitative data also provided rich descriptions of the factors that influence ICT competitiveness in South Africa.

The quantitative component of the study involved a survey of ICT firms in South Africa to measure their level of competitiveness and identify the factors that contribute to their competitiveness. This approach allowed for a systematic and empirical analysis of ICT competitiveness in the country.

By combining these two research methods, the study was able to overcome some of the limitations of using a single research approach. The use of a mixed-methods approach provided a more comprehensive and nuanced understanding of the research problem, and allowed for the triangulation of the findings to increase the validity and reliability of the results.

Also, in line with grounded theory methodology, the researcher commenced by identifying key concepts or variables as initial coding categories. In this study, some of the SVRs of the MNCs are identified from the existing literature through thematic analysis. The interviews were semi-structured. Questions from the interview protocol were first put to a selected initial participant. Selection of an initial participant is a contribution to the methodology. The selected participant has had long experience with the South African ICT industry and with ICT multinationals operating in South Africa. Subsequently other participants were interviewed using targeted questions based on predetermined coding categories. Additional codes were further developed. The entire process was iterative in accordance with grounded theory strategy to achieve theoretical saturation. Knowledge of the research subject and knowledge of

the organisations whose members were being interviewed enhanced the trustworthiness and interpretation of the data.

Overall, the methodological contribution of the study lies in its use of a mixed-methods approach to gather and analyze data, which allowed for a comprehensive and robust exploration of ICT competitiveness in South Africa. This approach can be useful for future research on complex and multifaceted topics in various fields, including ICT and economic development.

7.3.4. *Practical* implications

Theory should be useful both to other researchers and to managers (Bergh, 2003b; Corley & Gioia, 2011). Global competitiveness is vital to the South African ICT industry in the present era of globalisation and the 4IR. This study makes a valuable contribution to the South African ICT industry, entrepreneurs, financiers, the academic world and government policymakers.

a. South African ICT industry

South African ICT, especially in the manufacturing and software development sectors, has been provided with a framework of SVRs for each sector. By selecting certain SVRs, companies and businesses can improve their competitiveness and focus on how to compete with other businesses in their respective sectors or with multinationals in the overall sector. Attaining critical success factors using their SVRs will become an important part of company strategy and objectives. These SVRs could then become a valuable measure of company performance.

b. Entrepreneurs

Entrepreneurs and start-ups will have a framework of SVRs that can provide competitiveness for their ventures. This will constitute the launch platform.

c. Financiers

Financiers of start-ups and new projects have a framework of SVRs with which to evaluate the financial viability of start-ups and new projects. Currently, return on investment is the main criterion for the financial viability of start-ups and new projects.

d. Academia

This study indicates that the academic world holds a vast amount of intellectual property (IP) that could be used by the South African ICT industry. Conversion of this IP for commercial use will improve the competitiveness of the South African ICT industry and also the country's economic growth. With the right partnerships with industry, intellectual property can be put to commercial use.

This research also shows that the country's overall education and training are inadequate to assure the competitiveness of the South African ICT industry. Reassessment of education and training is necessary. The introduction of coding in schools is a welcome development. But without adequate teachers this will fall apart. Restarting teacher training colleges and training unemployed graduates as teachers could offer a way forward.

e. Government policymakers

This study has practical implications for government policymakers. Sections 5.4.3. and 5.4.4. dealt extensively with government policies and their implications for the competitiveness of the ICT industry. Both sections provide insights from technology leaders and recommended policy changes are presented as study recommendations in section 7.5. below.

The research concludes that South Africa's ICT industry is generally not globally competitive, except in the ICT service sector. Even the ICT service sector is dependent on multinationals for hardware, software and solutions. The study also shows that some government policies and positions have practical implications for the competitiveness of the ICT industry. These policies and positions are clearly outlined in section 5.4.4.

7.4. De-Limitations of the study and recommendations for future research

Firstly, the study is de-limited to the South African ICT industry. However, in the era of the 4IT the ICT industry is an all-encompassing one, it may be applicable to other industries in the country. Further research covering other industries would enrich the results obtained in this study.

The research presented here is limited to South Africa. Although South Africa is an ICT leader in Africa, the findings cannot be generalized to the rest of the continent or to other countries in the world. For this reason, future research in other counties has the potential to provide further insights that would enhance the results presented here.

Another de-limitation is that the study is cross-sectional and conducted over a short space of time. However, the opinions and experiences of the 14 ICT industry leaders are their long-held views, with their experience spanning more than two decades. As such, the views of these industry leaders are not expected to change in the near future.

Additional de-limitation is that the strategically valuable resources (SVRs) of the multinationals operating in South Africa are important reference points in this study. Nature of multinationals may change in future. New multinationals may operate in South Africa. As such further research may be required in future.

Finally, the study has raised serious questions about government policies. Specific policies in question are BEEE and employment laws. BEEE policies, as implemented from 1994, were necessary to rectify the imbalance created under apartheid. However, these policies also led to the loss of niche skills in the ICT industry. Coupled with globalisation, this skills loss has led to an influx of multinationals into the country as these have proved to be more competitive. Some participants also believed BEEE created a few owners who in turn became front companies for the incoming multinationals. flexibility on labour laws and tax incentives is needed for creativity and innovation. Current labour laws covering the basic conditions of employment do not encourage local start-ups and entrepreneurs. There could be flexibility on labour laws coupled with corporate tax incentives to encourage more local investment and start-

ups. In addition, government funding is needed to encourage creativity and innovation from high school to company level. Further research is needed to study the impact of these two polices on South African industries.

In summary the study illuminated the competitiveness of South African ICT industry and what is required to make the industry competitive in the era of globalization and fourth industrial revolution.

7.5. Recommendations to government policy makers

The study makes the following recommendations to government policymakers:

Firstly, the South African Government needs to address the current state of education and training. Although the government has made major improvements since 1994 in the availability of education and training, current results are not encouraging. There is a vast pool of unemployed matriculants and university graduates. It is important to have training institutions to prepare skilled ICT employees. Coding schools are an option. Coding institutions can be set up or supported by government to produce a large pool of affordable employees. Teacher training colleges can educate unemployed graduates to become teachers in the coding schools. Coupled with recommendations 1 and 2, this third recommendation can produce cost-attractive developers for the country.

Secondly, government should insist that multinationals, or local companies working with multinationals, change to local manufacturing of parts or components of the currently imported ICT equipment. Similarly, modules of currently imported software should be developed locally.

Finally, government should play a leading role in coordinating between the academic world and the private sector to leverage the intellectual property sitting in these sectors, thus enabling IP to be put to commercial use.

All the three recommendations presented above are dependent on each other and need to be implemented at the same time.

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APPENDIX A: Interview Protocol

a. Participant information sheet

Participant information Sheet H20/08/05
29 Aug 2020

Competitiveness of South African ICT companies

My name is Pius Anton Christopher and I am currently enrolled as a PhD candidate at University of Witwatersrand. I am working under the supervision of Dr. Horne. My research is aimed at determining the strategic valuable resources (SVR's) required to develop the global competitiveness of South African ICT industry. The research interviews will be conducted with experts within ICT industry in South Africa. Participants in this research will be providing their understanding on the global competitiveness of the South African ICT industry and identify potential SVRs for the South African ICT industry. SVRs are defined in the attached definition of terms.

I would like to invite you to participate in this research, due to your experience in the ICT industry. As a participant, you will be participating in remote (zoom or MS team) interviews with the researcher. The interview will be of an hour duration. The interviews will be auto recorded on your computer and the researcher's computer. The researcher will obtain the necessary permissions from your company. Interviews are expected to start in October and expected to continue in November.

Data collection will be kept confidential. The audio recordings and transcriptions will be kept in locked cabinets and password-protected files accessed only by the researcher and the research supervisor. All collected data will be kept for a period of 2 years after the publication of the research or 5 years if there is no publication of the research, after which all data will be destroyed. Anonymity in the final reports and publications will be maintained by using pseudonyms for each participant, and direct quote may be used in the final report. Your participation in the research is completely voluntary and you are free to withdraw at any stage, prior to the publication or presentation of the research, for any reason. You are also free to decline to answer any of the interview questions. There will be no reward or sanction for your participation in this research. Upon successful completion the study will be published by the University and be available online through the university library website. If you have any questions, please feel free to contact me on the details listed below. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Resources Ethics Committee (Non-Medical), +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za. If you agree to participate in the research, please complete the attached informed consent form and forward it back to me. The interview questions with definition of terms are also attached and if requested, a summary of the report will be provided.

Yours sincerely,

Pius Anton Christopher

b. Informed Consent form

Title of project: Competitiveness of the South African ICT companies:

Name of researcher Pius Anton Christopher

CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (or had explained to me) and understood the study as explained in the participant information sheet.

I have had sufficient opportunity to ask questions and am prepared to participate in the study.

I understand that my participation is voluntary and that I am free to withdraw at any time without penalty.

I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the interview.

Participant Name & Surname…… (please print)

Participant Signature……..Date……

Researcher's Name & Surname……(please print)

Researcher's signature……..Date……

c. Data collection procedures

a) Data will be collected from an Executive or Senior Manager of the organization.
b) Following preparation will be done before engaging the participant.
    a. Collect information about the participant from my contacts in the industry.
    b. Search for information on the organization in the public domain.
    c. Engage the participant to make the interview arrangements.
c) Following documents should be available before the interview.
    a. Participant information sheet which to be given to participant.
    b. 1 copy of informed consent form to be signed by participant.
    c. List of key questions.

Table 15: Key questions

Interviews are semi-structured interviews.

Key question	**Possible probing questions**
1. What do you think about the global competitiveness of South African ICT industry compared to ICT multinationals in South Africa?	Why do you think that they are globally competitive? Reasons Why do you think that they are not globally competitive? Reasons In which ICT fields are they globally competitive? Reasons In which ICT fields are they not globally competitive? Reasons

Key question	**Possible probing questions**
2. What do you think about the global competitiveness of multinationals in South African ICT industry?	Why do you think that they are globally competitive? Reasons Why do you think that they are not globally competitive? Reasons In which ICT fields are they globally competitive? Reasons In which ICT fields are they not globally competitive? Reasons
3. What are the strategically valuable resources (SVRs) of the multinationals in South African ICT industry?	What are the reasons? Pre-determined categories are used.
4. What are the firm capabilities required to make a South African ICT firm globally competitive? Researcher to clarify firm capabilities	Why are they needed? Pre-determined categories are used.
5. What will be the industry strategically valuable resources (SVRs) required to make a South African ICT industry globally competitive?	What are the reasons?
6. What are the industry capabilities required to make a South African ICT industry globally competitive?	What are the reasons?
7. What are the government policies needed to make South African ICT sector globally competitive?	What are the reasons?

d. Close of interview

Thank you very much for your time.

Your contribution has been very valuable.

May I contact you again for clarification or further discussion should this be necessary? Yes or No

Thank you again

Good bye.

APPENDIX B: Ethics clearance certificate

UNIVERSITY OF THE
WITWATERSRAND
JOHANNESBURG

Research Office

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

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H20/08/05**
PROJECT TITLE	Competitiveness of South African ICT companies
INVESTIGATOR(S)	Mr P Christopher
SCHOOL/DEPARTMENT	Commerce Law and Management/
DATE CONSIDERED	21 August 2020
DECISION OF THE COMMITTEE	Approved Risk Level: Low
EXPIRY DATE	12 October 2023

DATE 13 October 2020 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Dr R Horne

DECLARATION OF INVESTIGATOR(S)

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

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

Signature _____ Date 14 / 10 / 2020

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX C: Code Report

Table 16: Code groups

Code groups	Codes	Code
SA current strategically valuable resources (SVRs)	18	SA generalist SA private sector support SA workforce is young SA brand SA creativity SA delivery SA entrepreneur SA innovation SA IP SA knowledge SA management SA mobile services SA multi-skilled SA multitasking SA processes SA project management SA quality SA work attitude

Code groups	Codes	Code
MN strategically valuable resources (SVRs)	81	MN Govt +ve policies MN research and development MN investment MN techno-functional skill MN academic Industry collaborations MN automation MN balance skills on cost MN brand MN certified centres of excellence MN China MN cloud monitoring MN competitive MN cost-effective MN creativity MN culture MN currency exposure MN customer-first MN dealing with other MNs MN delivery MN differences MN economies of scale MN education MN education strategy MN entrepreneur MN equipment MN established companies advantage MN experience MN experts MN feeder university

Code groups	Codes	Code
		MN financing
		MN fixed-price projects
		MN global reach
		MN home environment
		MN imported technology
		MN India
		MN innovation
		MN international resource
		MN investment in products
		MN investment in skills
		MN IP
		MN knowledge
		MN knowledge pool
		MN knowledge sharing
		MN local resources
		MN market
		MN maturity of qualification
		MN motivation
		MN multi-skilled
		MN multitasking
		MN network coverage
		MN OEM
		MN off-shoring model
		MN partnerships
		MN pay for MN information
		MN performance
		MN persuasion
		MN policies
		MN population density
		MN processes

Code groups	Codes	Code
		MN product MN product life cycle MN project management MN quality MN real-time knowledge MN resources MN retail pricing MN service MN skills MN skills versatility MN software development MN specialisation MN strategy MN supply chain MN tailor-made programme MN teamwork MN technology MN total solutions MN training MN value MN work attitude MN work ethics MN work practice
SA Government policies	16	SA data strategy SA technology bursaries SA coding training SA data costs SA education SA education – too generalised

Code groups	Codes	Code
		SA energy assets SA Government support SA Government policies SA Govt policies with negative effect SA inequality SA infrastructure for education SA investment SA learnerships SA labour law SA tariffs
SA required strategically valuable resources (SVRs)	79	SA data strategy SA financial sector SA private sector support SA recruitment SA research and development SA tax incentives SA technology bursaries SA way forward SA workforce is young SA quality of life SA accuracy and precision SA adopt technology SA Africa model SA African success SA automated testing SA automation SA brand SA call centre SA coding training

Code groups	Codes	Code
		SA competitive day-by-day
		SA cost
		SA creativity
		SA culture
		SA customer base
		SA data costs
		SA delivery
		SA drones
		SA education
		SA education standards
		SA education – technology at lower level
		SA energy assets
		SA entrepreneur
		SA Government support
		SA Government policies
		SA higher education modernisation
		SA human resources
		SA ICT industry
		SA incremental innovation
		SA infrastructure for education
		SA innovation
		SA investment
		SA IoT services
		SA IP
		SA knowledge
		SA learnerships
		SA location-based systems
		SA management
		SA market
		SA mobile money

Code groups	Codes	Code
		SA mobile services
		SA motivations
		SA multi-skilled
		SA multitasking
		SA negotiating skills
		SA niche skills
		SA number of educational institutions
		SA processes
		SA project management
		SA quality
		SA recruitment
		SA research and development – negative
		SA re-skilling
		SA resource requirements
		SA resources
		SA service competitive
		SA short-term return
		SA skills
		SA skills-oriented education
		SA specialist
		SA strategic asset
		SA system integration
		SA tariffs
		SA technology
		SA testing resources
		SA training seen as least priority
		SA training seen as OPEX
		SA understanding of requirements

Code groups	Codes	Code
		SA WFH SA work attitude
SA why service competitive	13	SA brand SA cost SA delivery SA education SA government policies SA human resources SA innovation SA IP SA processes SA project management SA quality SA unskilled workforce SA service-competitive

Code groups	Codes	Code
MN competitiveness	85	ICT definition MN govt +ve policies MN innovation MN research and development investment MN Western MN techno-functional skill MN academic Industry collaborations MN automation MN balance skills on cost MN brand MN certified centres of excellence MN China MN cloud monitoring MN competitive MN cost-effective MN creativity MN culture MN currency exposure MN customer-first MN dealing with other MNs MN delivery MN differences MN economics of scale MN education MN education strategy MN entrepreneur start-ups MN equipment

Code groups	Codes	Code
		MN established companies advantage
		MN experience
		MN experts
		MN feeder university
		MN financing
		MN fixed-price projects
		MN global reach
		MN home environment
		MN impact of Y2k
		MN imported technology
		MN India
		MN innovation
		MN international resource
		MN investment in products
		MN investment in skills
		MN IP
		MN knowledge
		MN knowledge pool
		MN knowledge sharing
		MN local resources
		MN Market
		MN maturity of qualification
		MN motivation
		MN multi-skilled
		MN multitasking
		MN network coverage
		MN OEM
		MN off-shoring model
		MN partnerships

Code groups	Codes	Code
		MN pay for MN information MN performance MN persuasion MN policies MN population density MN processes MN product MN product life cycle MN project management MN quality MN real-time knowledge MN resources MN retail pricing MN service MN skills MN skills versatility MN software development MN specialisation MN strategy MN supply chain MN tailor-made programme MN teamwork MN technology MN total solutions MN training MN value MN work attitude MN work ethics MN work practice

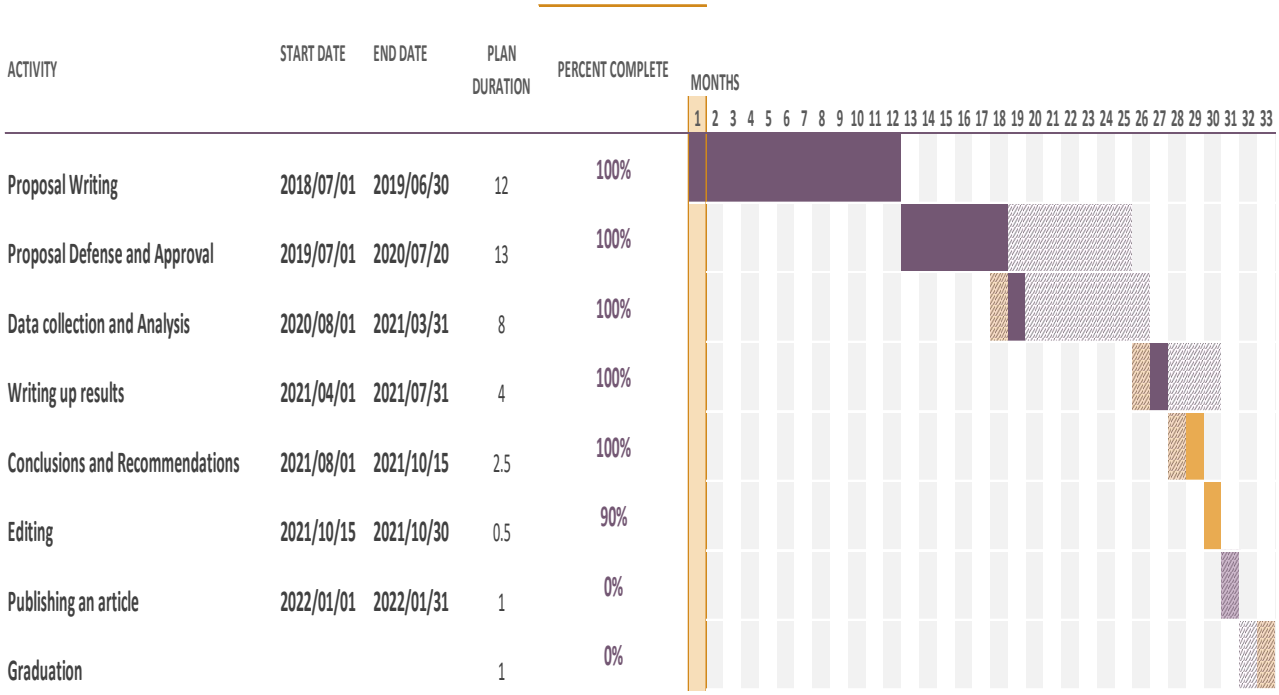
Code groups	Codes	Code
SA why not production-competitive	37	SA financial sector SA generalist SA private sector support SA research and development SA unemployment SA cost SA education – too generalised SA established companies have advantage SA government policies SA impact of globalization SA importing skills SA incremental innovation SA inequality SA infrastructure for education SA Innovation abroad SA international resources SA investment SA IP SA limited critical resources SA local presence SA not competitive SA not globally competitive SA not leader in SADC SA number of educational institutions SA population density SA production not competitive SA resources SA resources overseas

Code groups	Codes	Code
		SA short-term return SA skills SA support role SA training SA training seen as least priority SA training seen as OPEX SA understanding of requirements SA unskilled workforce SA usage imported technology
SA historical competitiveness	11	SA generalist SA education – too generalised SA Government support SA higher education modernisation SA historical competitiveness SA historical resources SA impact of globalization SA inequality SA innovation SA niche skills SA sanctions

Code groups	Codes	Code
MN knowledge	17	MN innovation MN research and development investment MN techno-functional skill MN competitive MN education MN experience MN feeder university MN IP MN knowledge MN knowledge pool MN knowledge sharing MN local resources MN OEM MN real-time knowledge MN teamwork MN technology MN training
SA training	10	SA generalist SA technology bursaries SA coding training SA government policies SA lack of training SA learnerships SA skills-oriented education SA training

Code groups	Codes	Code
		SA training seen as least priority SA training seen as OPEX
MN government policies	9	MN govt +ve policies MN currency exposure MN entrepreneur MN feeder university MN financing MN investment in skills MN IP MN policies MN skills
SA competitive in some sectors	3	SA competitive in some sectors SA competitive day-by-day SA service competitive
SA education	5	SA education SA education standards SA education – technology at lower level SA education – too generalised SA higher education modernisation

APPENDIX D: Research Schedule



APPENDIX E

Definition of terms

Terms that will be used in the study are defined as follows:

Term	Definition
Artificial Intelligence (AI)	Intelligence exhibited by computer systems. A machine exhibits AI when it can learn by itself (Brynjolfsson & McAfee, 2017). AI is the science and engineering of making intelligent machines, especially intelligent computer programs (McCarthy, 2007). It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable.
Augmented Intelligence	Augmented intelligence (AuI) integrates human intelligence (HI) and artificial intelligence (AI) to leverage their strengths and mitigate their weaknesses. The combination of HI and AI has seen to improve both human and machine capabilities, and achieve a better performance compared to separate HI and AI approaches (Yau et al., 2021).
Axiology	Inquiry is value-bound. Values are inherent in the context of the study. The researcher's values impact the study.(Samuel L Hart, 1971)
Blockchain	Platform for digital assets. Digital assets can be a continuously growing list of records that are linked and secured by cryptography. It is used in India by banks to move their digital assets online. It is also used as the base for crypto-currencies such as bitcoin (Phartyal & Tripathy, 2018).

Term	Definition
Broadband	High-capacity transmission method using a wide range of frequencies, enabling many messages to be sent or received simultaneously.
Cognitive technologies	Cognitive technologies are products of Artificial Intelligence (Schatsky, Muraskin, & Gurumurthy, 2015).
Cyber-physical systems	Integration of computation, the Internet and physical processes. Industrial cyber-physical systems are the backbone of the 4IR (Colombo, Karnouskos, Kaynak, Shi, & Yin, 2017).
Dual transformation	Transformation A should reposition the core business, adapting its current business model to the new marketplace. Transformation B should create a separate, disruptive business to develop the innovations that will become the source of future growth (Gilbert, Eyring, & Foster, 2012).
Epistemology	The researcher and the known are interactively linked. Findings are created as proceeds of research. Knowledge is gained through experience.
FinTech services	FinTech, or financial technology, is the term used to describe any technology that delivers financial services through software, such as online banking, mobile payment apps or even cryptocurrency. FinTech is a broad category encompassing many different technologies, but the primary objectives are to change the way consumers and businesses access their finances and to compete with traditional financial services (Sean, 2021). Examples are mobile wallets such as the WhatsApp wallet, cryptocurrencies and Blockchain.

Term	Definition
Fourth Industrial Revolution	Also known as the 4IR. Integration of physical, digital and biological technologies (Schwab, 2017). These are termed emerging technologies. Schwab as the chairperson of world economic forum defined Fourth industrial revolution.
High technologies	There are multiple definitions of High technologies. One of them defines high technologies as firstly in terms of complexity, which is a more or less astatic 'view on high technology and is applied to both the final product as well as the production process, Secondly the newness, relates to a requirement to continually update the products or processes (Steenhuis & De Bruijn, 2006). Technology used in space, air traffic systems, weapons systems, drones, scientific systems, satellite and similar technologies are complex and new. Advanced and sophisticated use of electronics too belong to this category. With the advent of the 4IR, high technology is integrated within emerging technologies and ICT.
Hyperautomation	Hyperautomation is a process in which businesses automate as many business and IT processes as possible using tools such as AI, machine learning, event-driven software, robotic process automation, and other types of decision process and task automation tools (Brian, 2021).
Information and Communications Technology (ICT)	Information and communications technology (ICT) is defined as a diverse set of technological tools and resources used to communicate, and to create, disseminate, store and manage information (Blurton, 1999).
ICT industry	The ICT industry consists of the ICT service sector (such as mobile operators, broadcasting and banking services that

Term	Definition
	utilise ICT), the ICT software development sector, the ICT manufacturing sector and the high-technology sector. In the era of the 4IR, ICT industry is a broad term encompassing many ICT sectors. With the advent of the 4IR, high technologies have become part of the other three sectors.
Internet of Things (IoT)	There are multiple definitions for the IoT, including: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies (ITU, 2012, 2017).
ICT production	Production of ICT hardware, software and solutions. In the 4IR, production of digital technologies to drive other technologies. ICT production comprises the ICT manufacturing and ICT software development sectors.
ICT manufacturing sector	The sector that manufactures hardware equipment, components and parts. With the advent of the 4IR, high technologies such as precision equipment and drones are included in the ICT manufacturing sector.
ICT services sector	The sector providing ICT services such as mobile operations, broadcasting services, call centres, banking services, cyber security, etc.
ICT software development sector	Software and solutions development. With the advent of the 4IR this sector includes AI, Blockchain development, big data analytics, etc.

Term	Definition
Nedlac	National Economic Development and Labour Council. A body that brings together the South African Government, labour and business to promote equity, growth and participation.
Ontology	Reality is constructed, subjective, multiple and relative. It is only informed, not measured.
Planned Opportunism	Sensitivity to weak signals and utilising non-linear thinking. Preparedness to abandon even current profitable operations in favour of future successes (Govindarajan, 2016).
Quantum computing	Quantum computers are machines that use the properties of quantum physics to store data and perform computations (Donna, 2022). This can be extremely advantageous for certain tasks where they could vastly outperform even the best supercomputers.
Singularity	The point at which AI supersedes human intelligence (Hawking, 2017; Goertzel, 2007).
Strategic assets	From the resource-based view, the strategic assets of a firm consist of strategic resources, competencies and capabilities. Resources can be tangible (staff, etc) or intangible (skills, patents) (Amit & Schoemaker, 1993).
Strategically valuable resources (SVRs), also known as strategic assets	Strategically valuable resources (SVRs) are company resources that enable a company to perform better or cheaper than its rivals (Anderson & Eshima, 2013). Strategically valuable resources (SVRs) are further discussed in the literature review. Strategically valuable resources (SVRs) can be physical assets (a prime location), intangible assets (a strong brand, intellectual property), or capabilities such as a super-efficient manufacturing

Term	Definition
	process. Strategically valuable resources (SVRs) have the following characteristics: they are difficult to replicate, they depreciate slowly, the company controls their value, they can't be easily substituted and finally they are superior to rivals' resources (Collis & Montgomery, 2008). They are rare resources. Barney (1991) defines an SVR as a resource with the potential to generate competitive advantage for the firm. In general, the number of firms that have an SVR is fewer than the number of firms needed to generate perfect competition in an industry.
Techno-functional	Technical experts who tend to learn the business requirements and processes and also acquire functional knowledge are referred to as techno-functional resources.
Theoretical sampling	Theoretical sampling is central to grounded theory. A theoretical sample is informed by coding, comparison and memo writing. Theoretical sampling is designed to serve the developing theory. Analysis raises questions, suggests relationships, highlights gaps in the existing data set and displays what the researchers does not yet know. By carefully selecting participants and by modifying the questions asked in the course of data collection, researchers fill gaps, clarify uncertainties, test their interpretations and build their emerging theory (Sbaraini, Carter, Evans, & Blinkhorn, 2011).
Theoretical saturation	Qualitative researchers generally seek to reach "saturation" in their studies. Often this is interpreted as meaning that the researchers are hearing nothing new from participants. In a grounded theory study, theoretical saturation is sought. This is a

Term	Definition
	subtly different form of saturation, in which all of the concepts in the substantive theory being developed are well understood and can be substantiated from the data (Sbaraini et al., 2011). Data saturation refers to the point in the research process when no new information is discovered in data analysis, and this redundancy signals to researchers that data collection can cease (Faulkner & Trotter, 2017).
Thick description	Detailed account of interview experiences in which the researcher makes explicit the patterns of cultural and social relationships and puts them in context (Holloway, 1997).
Total cost optimisation	By optimally blending high-cost resources with low-cost resources, total cost optimisation is achieved. US and Western multinationals have expensive resources such as business analysts or system analysts from their own countries, together with low-cost programmers from Third World countries.
Total experience	Total experience combines traditionally separated disciplines such as multi-experience (MX), customer experience (CX), employee experience (EX) and user experience (UX), and links them to create a better overall experience for all parties (Brian, 2021).
Total quality management (TQM)	Total quality management is an ever-evolving practice of doing business in a bid to develop methods and processes that cannot be imitated by competitors ((Dale, Van der Wiele, & Van Iwaarden, 1999).

Term	Definition
Trustworthiness	In quantitative research, trustworthiness refers to validity and reliability. In qualitative research, trustworthiness is about establishing credibility, transferability and dependability.