South Africa's Emergent Developmental State and the Challenges of Capabilities Development - Are Universities at the cutting edge of ICT?

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DECLARATION

By submitting this dissertation, I declare that the entirety of the work contained therein is my own original work, that I am the author thereof (unless to the extent explicitly otherwise stated). It is submitted in partial fulfilment of the requirements for the degree of Masters of Development Studies at the University of the Witwatersrand. I further declare that I have obtained the necessary authorisation and consent to carry out this research and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

Cindy Snyders

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My work is dedicated to my mother Rosita (Zietie) Constance Kenrick Snyders and is in memory of my father Fred Snyders and ‘Antie’ Kay (Doomsie) Miles.

ABSTRACT

The manufacturing sector contributed to growth in the 20th century, which ultimately enhanced capabilities related to machinery and plants. However, towards the end of the 20th century, the manufacturing sector became less prominent as a catalyst for growth as the economy became increasingly bit-driven. A bit-driven or knowledge economy characterises the 21st century, where economic growth is created through the expansion of ideas and the enhancement of human capabilities (Evans, 2007). In order to analyse the requirements of economic growth in the 21st century, I relied on the New Growth theory and the capability approach of Amartya Sen. The capability approach reviews state policies in terms of its impact on developing its citizens' capabilities, for instance, the ability to choose amongst Information and Communications Technology (ICT) courses at universities (Sen, 1990: 49).

South Africa has several policies in place which acknowledge the importance of a knowledge-based economy. It has also referred to the efforts of the African National Congress (ANC) to build a Developmental State (DS). This research examined several policies aimed at creating a 21st century DS and asks whether they enhance the capabilities of citizens to partake in the knowledge economy.

This paper looked at development during the industrialisation period (specifically after World War II). Here, economic growth was propelled through manufacturing. I drew on specific countries' experiences such as Japan, Korea and Taiwan, which were 20th century DSs. However, as the 21st century approached, the industrial revolution was replaced with a knowledge-based economy (KBE). The 20th and 21st century DSs are linked in that the manufacturing sector in the latter DS needs the services sector as a catalyst for job creation and economic growth. Therefore the manufacturing industry needs to diversify to include the services sector (Zalk, 2014).

Key words: Developmental state, capability, HEIs, knowledge-based economy, industrialisation, ICT

LIST OF ABBREVIATIONS:

ANC	African National Congress
ASSAf	Academy of Science of South Africa
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DST	Department of Science and Technology
DS	Developmental State
eLSI	eLearning Support & Innovation
FEBE	Faculty of Engineering and Built Environment
GNP	Gross National Product
HRSC	Human Sciences Resource Council
LSM	Learning Management System
NDP	National Development Plan
N.d.	No date
NGP	National Growth Path
NPC	National Planning Commission
R&D	Research and Development
SANReN	South African National Research and education Network
UCT	University of Cape Town
USA	United States of America
WITS	University of the Witwatersrand

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CHAPTER ONE: INTRODUCTION TO THE RESEARCH PROBLEM

1.1 Introduction

The DS, a type of 'ideal state', chooses sustainable economic growth as its main goal. The DS' involvement in the economic affairs of the state is aimed at enhancing the performance of its domestic economy to boost international competitiveness (Pempel, 1999: 139). The 20th century DS is mostly understood in terms of post-World War II East Asia, including the East Asia Tigers and 'city state tigers' of Hong Kong and Singapore, which managed to move from "underdeveloped" to "developed" in two generations (Evans, 2006: 5).

The role of the DS changed with the shift from the 20th to the 21st century DS (Evans, 2007). During the 20th century, the manufacturing sector was the main source of economic growth. Manufacturing jobs decreased globally by 22 million between 1995 and 2002. Towards the end of the 20th century, the service sector became more prominent and growth was increasingly generated through ideas and information. Evans refers to this as a 'bit-driven' or a knowledge economy (Evans, 2007). The 21st century DS, driven by the service sector, requires a new set of capabilities (Evans, 2011). In addition, the global technological revolution has also increased the need to create a knowledge-based economy (Blankley and Booysens, 2011).

Further to the requirements of the new catalyst for growth, the theories explaining development have also changed. Theories now include the New Growth theory and the capability approach, which feed into the shift towards the bit-driven economy and reflect the difference between the 20th and 21st century DSs (Evans, 2007).

1.2 Problem Statement

Development theories have changed the way in which forces of development have been viewed. South Africa has several policies which acknowledge the importance of a knowledge-based economy. The African National Congress (ANC) also emphasises its desire to build a DS in various policy documents. It refined its definition of a DS in 2012 during its National Policy conference as: "a state that develops the capabilities to guide national economic development through fiscal redistribution, mobilisation of domestic and foreign capital and other social partners, utilisation of State Owned Enterprises (SOEs), industrial policy and regulation" (ANC, 2012b: 15).

Since the ANC professed that South Africa was a DS, it committed itself to the improvement of its citizens' capabilities. This research will analyse the strengthening of ICT capabilities at tertiary institutions. It will not argue whether South Africa is indeed a DS, but will continue from the basis that it is, since South Africa has been declared so.

Various policy documents acknowledge the country's shift from a 20th to a 21st century DS, however it is not necessarily implemented uniformly and thus the effectiveness of enhancing capabilities must be questioned. The current deficiencies in the education system, especially in the Mathematics and Sciences fields, has produced a frail human capital state. Nearly 40% of population aged between 18 - 24 are unemployed or do not partake in any formal education or training, which further amplifies these challenges (NACI 2011/12).

1.3 Significance of the research study

This research is important for highlighting the role of Higher Education Institutions (HEIs) in DSs. Further, it also situates the role of universities in the state's quest to become a 21st century DS.

1.4 Research objectives

This research aimed to assess if South African HEIs are contributing to the development of post-graduate students' ICT capabilities, which are necessary for a 21st century DS. Further, it aimed to assess the current policy environment that supports or impedes the shift to a knowledge-based economy, characteristic of a 21st century DS. It aimed to answer the following research question and sub-questions:

Research question:

- Are South African HEIs developing tertiary education ICT capabilities?

Sub-questions:

- How do HEIs contribute to the DS?
- Is the South African policy environment conducive to the enhancement of the ICT capabilities of HEIs?

1.5 Research scope

The scope of this research was limited to one HEI in the Gauteng province of South Africa, the University of the Witwatersrand (Wits). I chose this HEI due to its accessibility and convenience, as I was a student at the university and had easy access to the participants who formed part of the research. I was also interested to assess how the institution performed in the development of ICT capabilities. This research will assist the institution to assess how it is contributing to the DS in South Africa, while the Department of Higher Education and Training (DHET) may also draw some lessons with regard to the implementation of a unified ICT strategy at HEIs.

1.6. Research limitations

Due to the time limits I experienced, a smaller group of participants was interviewed. From the group that was interviewed most of the interviews provided useful information, however due to the technicality of the subject matter (ICT) I often felt the need to do follow-up interviews, but this was not feasible due to time constraints on the part of the participants and myself. Instead, I conducted extensive background studies on the subject matter in order to grasp the content. Most of the interviews took place in a venue of each

participant's choice, and in some instances, the sound quality was poor due to background noises.

1.7 Assumptions of the research study

The basic assumption I made during the research process was that the South African government is not contributing to the development of ICT capabilities at HEIs. In addition, I also assumed that the South African DS is non-existent.

1.8 Layout of the research study

Herewith follows a brief outline of the research study:

Chapter 2: Theory and Literature review

This chapter looks at the definitions, characteristics and theories of the DS, therefore assessing the evolution of development over time. The process of industrialisation in East Asia is also explored by drawing on specific cases, and the 20th and the 21st century DSs are considered.

Chapter 3: Research Methodology

This chapter highlights the various research methodologies that were used throughout the process.

Chapter 4: Emergence of South Africa's Developmental State

This chapter examines South Africa's evolution from an Apartheid state to the quest to become a DS.

Chapter 5: South Africa's knowledge economy and ICT

This chapter assesses various policies and government speeches on ICT and the knowledge economy in South Africa.

Chapter 6: Case study: The University of the Witwatersrand

This chapter looks into the efforts, achievements and challenges experienced by the university. It focuses on specific capabilities such as research and ICT preparedness.

Chapter 7: Conclusion: Challenges and Recommendations

This chapter considers the progress made by the government and Wits, as well as the challenges experienced. It also includes recommendations for the improvement of capability enhancement of post-graduate tertiary students in the country.

CHAPTER TWO: THEORY AND LITERATURE REVIEW

2.1 Introduction

This chapter examines the various definitions of development and a developmental state. It further describes the characteristics and theories of the DS, allowing for an assessment of the evolution of development over time. The theories and approaches that will be discussed include the New Growth theory and the capability approach. This chapter also assesses the process of industrialisation in East Asia by drawing on the experiences of Japan, Korea and Taiwan. It compares the 20th and the 21st century DSs, and lastly considers the input of the knowledge-based economy and the role of ICT.

2.2 Definitions

For the purpose of understanding the DS in the context of this research, I considered the definition of a DS by Manuel Castells:

> "A state is developmental when it establishes as its principle of legitimacy, its ability to promote and sustain development, understanding by development the combination of steady high rates of growth and structural change in the productive system, both domestically and in its relationship to the international economy ... Thus, ultimately for the developmental state, economic development is not a goal but a means" (Castells, 1992:56-57 in Jomo and Fine, 2005: 103).

Johnson advised that if a state wishes to be a DS, it needs to emulate Japan's actions, i.e. "it must first of all be a developmental state" (Johnson, 1982: 306). Thereafter it can be whatever state it chooses to be, whether it is a regulatory, welfare or equality state. Thus Johnson emphasised first and foremost the economic development of a DS (Johnson, 1999; Johnson, 1982). Önis on the other hand, simply defined a DS as "state where government is intimately involved in the macro and micro-economic planning in order to grow the

economy" (Önis, 1991 in Marwala, 2006: 1). Overall, the commonality amongst the definitions and descriptions considered emphasises economic planning as a priority by government in order to strengthen the economy.

The DS is one of three different classifications of "ideal" states which Pempel made reference to:

- The DS chooses sustainable economic growth as its main goal.
- The aim of the DS' involvement in the economic affairs of the state is to enhance the performance of their domestic economy, thereby increasing its global competitiveness.
- DSs create their competitive advantages instead of merely accepting their comparative advantages (Pempel, 1999, 139).

Development, on the other hand, was defined by Mkandawire as a process that enhances people's capabilities, alleviates human suffering and results in increased choices (Mkandawire, 2011: 9). Since this research focused on development as a process of enhancing human capabilities, it considered Mkandawire's definition of development, coupled with Castells' overview of a DS, which places economic growth as its main priority.

2.3 Origin of DS in the 20th century

The term 'developmental state' was first used by Johnson in his work on Japan, in *MITI and the Japanese Miracle: The Growth of Industrial Policy, 1925-1975*. Afterwards the term referred to other Asian countries such as South Korea and Taiwan (Sanlam, 2007). Although the well-known literature of these countries span from the mid-1960s to the mid-1980s, Evans noted that it is important to consider the expansion of these countries' progress until the present (Evans, 2012: 3).

The phenomenon of state-led macroeconomic planning in Asia, where the state had autonomous political power as well as control over the economy, became synonymous with the concept of a developmental state (Mkandawire, 2011: 95). Further, Pempel (1999) attributed the success of the DS to the government's firm hand over various elements for economic success. This includes several factors such as, but not limited to, the ability to obtain capital; the ability to formulate and enforce economic policies; affording access to the state's sparse resources; being able to strategically select industrial projects; and encouraging technological advancement (Pempel, 1999). These elements are especially true for the cases considered later on in the research such as Japan, South Korea and Taiwan. Nonetheless, the state was always at the heart of the "study of development", even before development was considered to be a subject matter during the 19th century (Fine in Jomo and Fine, 2005: 102).

According to Evans, the concept of the DS had two main roles during the 1980s and 1990s. First, it offered an alternative to the prevailing neoliberal policies where the market was responsible for economic growth and development. With the rise of the Washington Consensus during the 1980s, the state took a back seat in the process of development. The state was accused of, and criticised for, advancing its own interests through activities such as rent-seeking or corruption. Therefore it was considered that development would occur through the liberalisation and guardianship of the market forces (Fine, 2005: 102). The second role of the DS is the explanation for the economic success experienced in the East Asian region (Evans, 2012: 3).

2.4 Characteristics of a DS

Marwala offered a few characteristics of a DS. First, a DS realises the importance of technical education, numeracy and computer skills, and thus its citizens have these capabilities (Marwala, 2006). Similarly, Nelson (2005) believed that technological advance is linked to the applied Sciences and Engineering fields. This is because scientific knowledge serves as navigation to the best suitable innovations. Further, these technical skills augment the bureaucracy within government by increasing its capacity. Consequently, government officials become capable and effective decision makers, efficiently allocating resources to

various governmental departments (Marwala, 2006: 2). However, the benefits of education may be limited if it is not accompanied by technological improvements (Nelson and Phelps 1996). In fact, Nelson and Phelps (1966: 70) came to the conclusion that "education has a positive payoff only if the technology is always improving". After illustrating the examples in the agricultural sector and how they may be extended to other industries, they further tested two models and concluded that a relationship exists between the "capital structure and technological progress" (Nelson and Phelps, 1966: 75). Education, in their view, can be seen as an investment in citizens, and subsequently educated citizens become the conveyers of human capital (Nelson and Phelps, 1966: 75).

Similarly, Pack stated that education can strengthen problem-solving abilities in the presence of technological change, but without it, will not yield any benefits. Therefore even if a country invests in higher education, if this investment is not accompanied by imported technology such as "equipment, intermediates or production engineering knowledge", this will merely lead to a reproduction of existing knowledge that exists abroad (Pack, 2001: 124). Pack also found that countries in East Asia employed the support of public institutions to reinforce the private sector's abilities, such as the Korean Institute for Science and Technology as well as the China Productivity Center in Taipei. Even though East Asian countries made a conscious effort to build a strong educational system with special emphasis on scientific knowledge, this effort would not have had any impact if not for the support of the economic policies which called for a special focus on an increased number of graduates (Pack, 2001 in Stiglitz and Yusuf, 2001).

Second, DS' are also able to disburse resources efficiently, thus enabling them to invest appropriately in specific areas such as education. This ability to allocate resources efficiently is the foundation of industrialisation (Marwala, 2006). Similarly, Bodibe concurred that the East Asian DSs focused on building a strong investment environment, by investing in the necessary infrastructure and human capital. This led to a "strong capital base and a highly skilled labour force" (Bodibe, 2008 in Turok, 2008: 215).

Third, DS are protective of their emerging industries whilst acquiring foreign technology (Marwala, 2006: 2). In addition to the focus on scientific knowledge, East Asian states also focused on the importation of foreign technology where there were no restrictions on the licensing of foreign technologies (Stiglitz and Yusuf, 2001). Moreover, DSs also reward and encourage foreign firms to invest in manufacturing industries, hoping that their companies will benefit from these firms by becoming a success (Marwala, 2006: 2).

The last characteristic of a DS is that they attain their legitimacy through the provision of social services to its citizens, instead of relying solely on the ballot. However, in South Africa the result of the ballot is not determined by the success of service delivery as yet (Marwala, 2006). Bodibe concurred with Marwala and gave specific input regarding the characteristics of a South African DS and what it would require. He was of the view that although the government has made remarkable progress in transforming the state, the transformation process is still incomplete and should be addressed if the country is to become developmental (Bodibe, 2008 in Turok, 2008).

Regarding the issue of service delivery, the state simply lacks the ability to meet the necessary requirements, due to a lack of appropriate skills and ineffective coordination between the different governmental departments. Another requirement is to strengthen the capability of government to successfully conclude projects. This requires the strengthening of the state's internal organisation capacity. In addition, the organisation of the state should be supplemented with effective coordination in order to ensure the successful execution of its developmental plan. Therefore, the government has to address the lack of critically skilled staff in service delivery areas as it is an imperative of a DS to allocate the necessary resources towards increased capacity (Bodibe, 2008 in Turok, 2008: 221).

2.5 Theories of the Developmental State

A common theme throughout the various definitions of development is the concept of change. During the 1950s and 1960s, development was understood as being a process of structural societal change (Thomas, 2000; Veltmeyer, 2010). During the 1950s economic

growth was the main driving force of less developed countries, as they believed that economic growth and modernisation would lead to a reduction in social inequalities. Gross National Product (GNP) growth became the primary focus of development since it was used to measure economic development. Some of the theories considered by developmental economists included the 'big-push' (Rosenstein-Rodan, 1943), 'balanced growth' (Nurkse, 1953) and the stages of growth by Whitman (Rostow, 1956; Thorbecke, 2006). This period marked the importance of investment, and thus industrialisation was perceived to be the main source of economic growth, providing additional employment to the agricultural sector (Thorbecke, 2006).

The 1960s also emphasised theories of economic growth focusing on economic dualism, as described in the work of Lewis (Thorbecke, 2006). The agricultural sector was viewed by the mid-1960s as being a capable producer of resources and a reliable partner within the modern sector. The effect thereof could best be described in the following manner: "the backwards agricultural goose would be starved before it could lay the golden egg" (Thorbecke, 1963 in Thorbecke, 2006: 7). By the 1970s, development was viewed as equitable growth and increasing inequality (Veltmeyer, 2010). The GNP as a measure of growth was not discarded altogether, but instead it incorporated social development. It therefore aimed to address issues such as increasing levels of poverty, unemployment, rural and agricultural development and basic needs such as health and education (Thorbecke, 2006). The state, as the main actor, was considered to be the leader in this new, poverty-focused approach to development (Veltmeyer, 2010).

Structural transformation took place during the 1980s and focused on equity and sustainable human development (Veltmeyer, 2010: 28-29). Some of the influential theories that arose during this time were the New Growth theory and the capability approach[1] (Thorbecke, 2006).

[1] The New Growth theory and the capability approach will be discussed in more detail shortly.

By the 1990s, neoliberal policies came under criticism, sparking an intensified call for a focus on education and health, amongst others. Due to the effects of the Asian financial crisis, the appropriate role of the market versus the state in the process of development was questioned. This debate is still ongoing, but it has been recognised that the government can contribute to the necessary institutional infrastructure that enables peace, law and order, as well as deliver basic health care, education and the infrastructure to assist in the delivery of these opportunities to enable economic growth (Thorbecke, 2006).

2.6 New Growth Theory / Endogenous Growth

The New Growth theory or the Endogenous Growth theory was proposed by Lucas (1988) and Romer (1990). Endogenous growth focuses on the investment of human capital through the deliberate investment of resources such as research and design (R&D). It also called for an expansion of government's role in the provision of education and training as the market was unable to do so (Thorbecke, 2006) .

The core proposition of the New Growth theory is that knowledge propels growth. This is because of the limitless characteristic of ideas which are not exposed to "diminishing returns", but rather "the increasing returns to knowledge propel economic growth" (Cortright, 2001: 2). The New Growth theory forms an important area of study since the world has shifted from a resource-based economy to a knowledge-based economy (Cortright, 2001). As will be discussed later in the paper, the knowledge-based economy is reliant on the creation and dissemination of new knowledge, which leads to growth in the economy as well as in individual companies and communities (Cortright, 2001: 1).

The New Growth theory propose two important views. First, it holds that technological progress is an outcome of economic activity. Previous theories of economic growth viewed technology as an exogenous factor, thus describing growth as a given. The New Growth theory on the other hand, attempts to explain the source of technological progress; the rate of long run economic growth is therefore determined by technological forces that are internal to the economic system (Cortright, 2001: 2). Second, the New Growth theory links

the rate of technological progress to investment in knowledge (R&D), which is characteristic of increasing returns, in contrast to physical objects which are characteristic of diminishing returns (Cortright, 2001).

Abramovitz (1952) clearly understood the issues related to technological advancements even before the publications on Modern Growth theory in 1956 by Solow and Swan (Nelson, 1997: 31; Nelson, 2005: 16). His chapter published in *A Survey of Contemporary Economics* in 1952 focused on "the economics of growth" (Nelson, 2005: 16), where he proposed that technological advancements are endogenous due to investments that seek the creation and exploitation thereof (Nelson, 1997: 38).

2.6.1 The New Growth theory as it is today

The New Growth theory purportedly addresses the shortcomings of the neoclassical model by introducing two important elements which create long run endogenous growth. These are human capital and knowledge (Lui, 2007: 10). It attempts to address the "failure of … conditional convergence by proposing the externalities and spill over effects on human capital and knowledge" (Lui, 2007: 15). Human capital is defined as "the accumulated stock of skills and education embodied in the labor force" (Lui, 2007: 15-16).

> "The physical world is characterized by diminishing returns. Diminishing returns are the result of the scarcity of physical objects. One of the most important differences between objects and ideas . . . is that ideas are not scarce and the process of discovery in the realm of ideas does not suffer from diminishing returns" (Romer as cited in Cortright, 2001: 4).

Knowledge is considered to be a non-rival good as it is exposed to increasing returns. It is precisely the characteristic of non-rivalry that allows knowledge to propel economic growth. Thus the New Growth theory hypothesises that by increasing and improving the knowledge of how to produce more efficient goods and services, we will be able to improve living standards for generations to come with even fewer physical resources (Grossman and Helpman, 1994, in Cortright, 2001: 6).

2.7 Amartya Sen's Capability Approach

The capability approach, as proposed by Sen, gave rise to the interpretation of freedom as the realisation of basic needs such as access to education and health facilities (Veltmeyer, 2010), as well as the ability to choose one's functionings (Thorbecke, 2006). The capability approach serves as a tool to examine a wide variety of social issues such as poverty. For Robeyns, the capability approach provides first and foremost a "frame of thought", instead of providing a "formula to make interpersonal comparisons of welfare" (Robeyns, 2000: 3; Robeyns, 2005: 96).

2.7.1 Functionings

The main elements of the capability approach are functionings, capabilities and agency. During the Tanner Lectures on Human Values, Sen described functionings simply as "the living conditions we can or cannot achieve" (Sen, 1985: 23). Clark drew on Sen's definition of functioning as "… an achievement of a person: what she or he manages to do or be" (Sen 1985: 10, in Clark, 2006: 4). Functionings therefore refer to a person's set of "doings and beings", thereby determining a person's quality of life, such as being in good health, for example (Hick, 2012: 2; Robeyns, 2000: 4). People should be able to choose various functionings, whether they are basic functionings such as nourishment or more complex functionings such as self-respect (Sen, 1990).

2.7.2 Capability (and Freedom)

Capability is the ability to achieve the desired amalgamation of various functionings (Sen, 1985: 23; Sen, 1990). If capability refers to an ability to achieve, then functionings refer to the achievement (Robeyns, 2000: 4). The issue of freedom is an important aspect of capability (Sen, 1992: 40, in Alkire, 2005: 121). Sen defined freedom as "the real opportunity that we have to accomplish what we value" (Sen, 1992: 31, in Alkire and Deneulin, 2009: 11), thus capability is much broader than the ability to achieve a set of functionings and so, in addition, refers to the freedom one has to choose amongst those functionings (Hick, 2012).

Freedom is mirrored by a "set of vectors of functionings" (Sen, 1992: 40, in Alkire, 2005: 121), enabling a person or group to choose the life they want to lead (Alkire, 2005). Thus it remains unimportant whether the person chooses to act on their functionings, but rather that the freedom of choice exists (Hick, 2012). The concept of freedom is further analysed to incorporate two elements. This is important for the reader to grasp since it bears on agency, which is the third concept of the capability approach (Alkire and Deneulin, 2009,) which will be discussed in the following section.

Sen purported that freedom entails two critical features: the 'opportunity' and the 'process' features. First, the 'opportunity' feature focuses on a person's ability to achieve "those things that she has reason to value" (Sen, 2002: 10, in Alkire and Deneulin, 2009: 11). Thus, Sen stated in *Development as Freedom* that the opportunity aspect of freedom refers to the opportunities that people can access to expand their freedom. The denial of these opportunities lead to unfreedom, or being unable to take advantage of an opportunity due to insufficient opportunities provided. The effect thereof results in people being unable to achieve what they initially set out to (Sen, 1999).

Second, the 'process' element of freedom focuses on "the freedom involved in the process itself" (Sen, 2002: 10, in Alkire and Deneulin, 2009: 11). It entails social, economic, political and civil aspects which will be described briefly. Examples of social and economic factors of freedom include the freedom to enjoy good healthcare or education. Civil rights or political freedom include the freedom to engage in community discussions without fear. This is not to say that industrialisation and technological improvements are not important, but rather these processes of modernisation contribute to the improvement of human freedom. Yet in order for development to occur, there needs to be "a removal of major sources of unfreedom" (Sen, 1999: 3), such as poverty, lack of access to education, health and so on (Sen, 1999).

Sen also made reference to institutional freedom, which assists people to enjoy more freedom. There are five different institutional freedoms, but only social opportunities are described briefly as they pertained to this research. Social opportunities are "the arrangements that society make for education, health care...which influence the individual's substantive freedom to live better" (Sen, 1999: 39). These are critical as they enable the person to partake in economic, political and social opportunities. Should these social opportunities not be provided, such as, for example, literacy, it may prevent the person from engaging in meaningful economic activity. This may further prevent political activity as the person may be unable to keep abreast of current affairs by reading the newspaper or engaging in further political activities (Sen, 1999).

Consequently, the concept of capability draws on the 'opportunity' element of freedom, whereas the 'process aspect' of freedom draws on the concept of agency (Alkire and Deneulin, 2009: 11).

2.7.3 Agency

The concept of agency in the context of the capability approach is defined as "the ability to pursue goals that one values and has reason to value" (Alkire and Deneulin, 2009: 8). Therefore, people are agents and "agency is an assessment of what a person can do in line with his or her conception of good" (Sen 1985b: 206, in Alkire, 2008: 4). Sen further proposed that those who are able to display increased levels of agency are those who are in line with their values (Alkire, 2008).

2.7.4 Capability Approach

The crux of Sen's capability approach is its emphasis on people's capabilities; the possibility of what people can do and be (Robeyns, 2005: 94) with the freedom one has to choose amongst various functionings (Hick, 2012). Since the definition of capability refers to the coexistence of functioning and freedom, it follows that Sen's capability approach is a hypothesis which proposes that social arrangements should be analysed in terms of the amount of freedom it offers people to achieve the functionings that are of value to them

(Sen, 1992; 1996b, in Alkire, 2005: 122). Further, Sen proposed that state policies should therefore be analysed in terms of the extent to which they promote the space for people to achieve their capabilities and the extent to which they effectively remove obstacles so that they may increase the freedom to "live the kind of life that, upon reflection, they have reason to value" (Robeyns, 2005: 94). This is because the state is viewed as the main actor which can achieve developmental priorities through its collaborative decision-making processes in the formation of economic policies (Evans, 2005). As the state's policies directly impact people's capabilities it ensures (or in some cases fail to ensure) that sufficient resources are set aside for its citizens' capabilities (Robeyns, 2005: 95-96).

The capability approach further postulates that when viewing development, people's opportunity to partake in activities of value as well as the opportunity to become who they want to, should be the core focus. Therefore, the state's developmental objectives should prioritise "capabilities to function" as the combination of functionings enable a life of value (Robeyns, 2005: 95). Not only does the capability approach view the expansion of capabilities as the role of development, but it also sees it as the means through which development can be achieved (Evans, 2007).

In essence, the capability approach envisages that people are enriched with capabilities (freedom to choose amongst choices of value) to do and become what they've envisioned so that they may live the life they would want to. At the end, once people have acquired the various opportunities to choose from, they are capable of choosing the best opportunity suitable for them (Robeyns, 2005: 95). Should citizens be unable to choose amongst their functionings, this would limit their freedom; as Sen stated, "Certainly, freedom is a means to achievement" (Sen, 1990: 49). Capabilities are also at the heart of the 21st century DS[2]. In essence it defines what the 21st century must do in order to be 'developmental', i.e. "a 21st century developmental state must be a 'capability-enhancing state' " (Evans, 2010: 38).

[2] Developmental states of the 20th and 21st centuries are discussed in more detail later in the literature review.

2.7.5 Strengths of Sen's Capability Approach

One of the main strengths of Sen's approach is its adaptability, allowing for multiple applications and developments. This allows for flexibility in the approach as Sen does not prescribe a formal list of capabilities, but rather suggests that capabilities should be considered according to an individual's preferences (Clark, 2006: 5).

In addition, the capability approach allows for a broad set of utilisation as it is not limited to a set of functionings or abilities; a narrow set of functionings or capabilities may not be relevant to every evaluation (Alkire, 2005: 119). Clark concurred and stated that this strength allows for the accommodation of multifarious cultures, values and goals (Clark, 2006: 5).

2.7.6 Criticism of Sen's Capability Approach

The capability approach is criticised for referring to human freedom in terms of individual freedoms achieved through individual efforts. Deneulin and McGregor (2009: 4) argued that people live in a wider society producing social goods, hence human freedom should be considered within a wider societal framework. Furthermore, Amsden questioned whether improving capabilities will increase employment opportunities. She postulated that if the state invests in the capabilities of jobseekers, whether it is health, education or housing, it may not necessarily create more jobs, but will just create more educated unemployed people. She advised that policymakers must ensure that the number of employment opportunities available are sufficient to absorb the society's elevated skills, otherwise people will end up settling for lower-paying jobs (Amsden, 2010). It thus follows that should government increase investment in tertiary education it may not necessarily create employment opportunities for these graduates; it may just lead to a 'brain drain' where graduates seek jobs overseas. Amsden, therefore, held that "jobs do not necessarily make an appearance simply because the supply of qualified job seekers improves as a result of grassroots activism. The demand side must also be improved" (Amsden, 2010: 60). For this reason, the demand for jobs needs to correlate to the type of skills and education that are invested in, in order for the economy to absorb these employable people.

Amsden postulated that the demand for jobs should be increased. With the unemployment rate in South Africa at 24.7% in 2013, it seems imperative to do so (Statistics South Africa, n.d.). However, the inability to cater for the growing youth labour force is not specific to South Africa alone. The most recent African Economic Outlook (AEO) released by AfDB, the OECD Development Centre, the United Nations Economic Commission for Africa (UNECA) and the UN Development Programme (UNDP), commissioned the study : "Promoting Youth Employment 2012". The report found this to be a trend throughout the continent and that the "existing private and public employment capacity is simply too small" (African Economic Outlook, n.d.). Similarly in South Africa, even with the government's policies and plans, the number of opportunities for young people remain limited (Patel, 2012).

The African continent has been described as the fastest growing region; housing six of the world's fastest growing economies between 2001 and 2010 in sub-Sahara Africa. However, the continent also has the youngest population in the world as almost 200 million people between the ages of 15 and 24 are in Africa. The report by the AfDB estimates that this figure will "double by 2045". Between 2000-2008, the continent's "working age population (15-64 years) grew from 443 million to 550 million; an increase of 25%" (African Economic Outlook, n.d.: para 3). If this growth trend continues, it is expected that the region's labour force will stand at one billion by 2040; therefore crowning the continent with the largest workforce globally, overtaking both China and India (African Economic Outlook, n.d.). However, even with this vast growth trend, it still does not equate into equal opportunity.

Then, in order to address the issue of an increased youth labour force with little to no opportunities, what can be done to redress this in South Africa? Mr. Ndabakayise Gcwabaza, an ANC MP, stated at a Budget Debate in 2012, that the private sector is in need of a "skilled and productive workforce" (ANC, 2012a: para 9). Accordingly, the national skills Accord has been signed by the Department of Economic Development and the Department of Higher Education and Training in order to scale-up the capabilities needed to strengthen the economy (ANC, 2012a). Further, I think that private sector and public sector investments need to be increased. Here I am in agreement with Amsden, that even though the skills and competencies of the unemployed youth are addressed, it will not relate into equal job availability. Referring to the fact that the continent has the fastest growing population in the

world, there needs to be increased investment by the government and private sectors equally. Luella Krugel, a senior economist at KPMG in South Africa is of the view that the unemployment problem could reversed if “private investment in South Africa can be increased to least 20% of GDP and government investment to 10% of GDP (Fin24, 2013). Former Minister of Finance, Mr. Pravin Gordhan informed parliament at the 2014 Budget speech delivery that public and private investment is needed to create jobs and economic growth. In doing so, the government will provide a supportive policy framework and a conducive and attractive environment for both domestic and international companies (SouthAfrica.info, 2014). Thus in summary, there is a need to correlate the skills needed in the economy and to increase investment by both the private and public sectors in order to create more employment opportunities for the youth.

2.8 Industrialisation in East Asia

Developmental states have been drawing heavily on strategic developmental policies which includes its industrial policies (Sindzingre, 2004; Önis, 1991). Wade defined industrial policy as "any sectorally or activity-targeted interventions, including in agriculture and services" (Wade, 2009: 352). According to Marwala (2006), the role of industrialisation is to enable a country to produce high-value added goods and services. Low-income countries are generally found to export goods that allow for low wages, whereas the opposite holds true for rich countries (Wade, 2009: 356). Sindzingre (2004) held that industrialisation strategies of DSs included flexibility as well as the implementation of supervisory mechanisms which enhanced institutional performance. The DSs of East Asia were remembered for, amongst other factors, the state’s intervention in the economy, as they realised that economic growth could not occur solely through the efforts of the market. In order to understand the industrialisation process in East Asia I considered the cases of Japan, Korea and Taiwan.

2.8.1 Japan

Johnson (1982: 309-310) advised that if a state wishes to be a DS it needs to emulate Japan’s actions, i.e. “it must first of all be a developmental state”. Thereafter it can be whatever state it chooses to be, whether it is a regulatory, welfare or equality state. In this way the state manages to avoid conflicting priorities (Önis, 1991: 111). The marriage between “state

bureaucracy" and "private property" posed a problem for economic growth steered by the state. However over the course of 50 years, Japan dealt with this through various mechanisms such as controlling the state, self-control and initiating cooperation. By implementing these mechanisms, the Japanese DS ensured that its development remained the most important goal (Johnson, 1999: 37; Johnson, 1982: 309-310). Johnson (1999) described his view of a "capitalist developmental state" as one which focuses on economic development as its main goal, and ensures that its actions are aligned to the achievement of this goal (Önis, 1991).

By studying the operation and elements of the Ministry of Trade and Industry (MITI) of Japan, Johnson established that Japan adopted a small agency. This highly educated, yet inexpensive, agency, had specific responsibilities:

1. In order to align the state's goals with its industrial policy, the elite team identified and selected the industries that the state should develop.
2. Developing industries in the shortest time possible.
3. In order to ensure the effectiveness of these industries, the bureaucracy was tasked with overseeing competition through direct state intervention (Johnson, 1999: 38; Johnson, 1982: 314-315).

2.8.2 Korea

a) Statist Thesis

When looking at the process and impact of industrialisation in South Korea, Chibber looked at the statist thesis and two schools of thought that deviated from it: the continuity thesis[i] and the statist discontinuity thesis[3]. The statist thesis based Korea's success on the state's dominance over its business sector, as well as its ability to discipline it (Chibber, 1999;

[3] Only the statist thesis has been discussed. For a brief overview of the continuity and statist discontinuity theses, refer to Chibber (1999).

Vartiainen, 1999). The state used mechanisms such as laws and policies regarding taxes and exchange rates, therefore the state was able to select specific companies and sectors and influence the decisions in those sectors. These orders were very strict and companies that did not follow the government's instructions often found themselves in trouble. Statists therefore argued that the industrialisation process in Korea was successful due to the power over its capitalist class, and this was the distinguishing factor over the other DSs during the post-World War II period. Chibber (1999) argued, however, that this explanation is insufficient to delineate the rise of Korea as a DS, as it fails to consider how the state acquired the power to influence the business sectors.

Chibber (1999) proposed that Korea's success could be attributed to the capitalist class' enthusiasm which was unusual at the time, rather than the state's dominance over the business sector. This enthusiasm also contributed to an alliance between Korean and Japanese firms, giving Korea access to markets that they would otherwise not have had access to. This is not to discredit the statist's theory altogether - the state did discipline its capitalist class, but only to a certain extent. Vartiainen (1999: 226), however, argued that Korea's industrialisation strategy was reliant on the strong base of the "rapid education of a class of salaried engineers and other white collar workers", and this restricted the government as it could not afford a student rebellion.

b) The Move to Export-led Industrialisation

Korea's success as a DS, Chibber (1999: 327) argued, is due to two factors in its industrial policy: its "state economic apparatus" and its "economic strategy". Regarding the first factor, Korea nationalised its banks in 1961 and thereafter implemented various economic reforms to control financial activities. It also formed an institution to lead the growth process in the Economic Planning Board (EPB). Regarding its economic strategy, Korea replaced its import substitution industrialisation (ISI) policies, which had formed part of its main economic strategy since the 1950s, with export-led industrialisation (ELI) policies (Chibber, 1999: 312). Exports became the pillar of its economic strategy by 1965. It is important to note that Korea's export strategy differed from the export promotion strategies common amongst developing countries at the time; Korea's export-led strategy

put exports at the centre of the state's economic planning. Companies which wished to access state subsidies had to show exceptional export performance. As Korea made ELI the basis of its industrial policy planning, firms were required to venture into foreign markets. Companies which did not perform were disciplined and did not have access to any benefits from the state (Chibber, 1999).

Thus Chibber, in contrast to the statist thesis, argued that Korea's successful industrialisation was due to two factors. First, the relationship between Japan and Korea allowed Korean exporters to gain entry into the markets in the United States, which would have been inaccessible if not for their relationship with Japan. Second, Korea was considered to be a state equipped with special skills, which was a contributing factor to its success (Chibber, 1999: 338).

2.8.3 Taiwan

Similar to Korea's EPB and Japan's MITI, Wade (2009) referred to Taiwan's Industrial Development Bureau (IDB), which not only consisted of economists but also included industrial engineers, corporate experts, and accounting professionals. However, unlike MITI, the IDB was large, comprising of 180 staff. The IDB had several functions but one of its main goals was to ensure consistent feedback and suggestions on how to improve the capacity of the companies in Taiwan's productive sector. The Bureau also kept abreast of technological requirements, thus they were responsible for improving the machinery and acquiring complementary tools. Further, the IDB also encouraged multinational companies to use inputs produced domestically instead of relying solely on imported goods. Taiwanese companies, on the other hand, received regular feedback regarding ways to improve their performance and were systematically informed of opportunities to venture into new activities (Wade, 2009).

Another common denominator between Korea and Taiwan is the influence of government to discipline companies. For instance, the IDB convinced the company Philips to procure glass from local Taiwanese companies by delaying its requests to import glass (Wade, 2009).

2.9 Developmental states of the 20th and 21st centuries

The 20th century DS is mostly understood during post-World War II East Asia, including the East Asia Tigers and 'city state tigers' of Hong Kong and Singapore, which managed to move from 'underdeveloped' to 'developed' in two generations (Evans, 2006: 5). Between the 1960s and the 1990s, countries such as Korea and Taiwan evolved into technologically advanced and economically prosperous countries; both managed to increase their per capita income extensively (Nelson, 2005: 40). These countries therefore surpassed the economic growth of other countries that had similar income levels and productivity during the 1960s (Nelson, 2005).

Two features of the 20th century DS are embeddedness and bureaucratic capacity. Embeddedness is defined as "dense networks of ties connecting the state to industrial elites" (Evans, 2011: 10). The East Asian DSs are renowned for their embedded autonomy as they were able to discipline the private sector, as discussed in the cases of Korea and Taiwan (Evans, 2010), thus allowing East Asian economies to inject high levels of investment into key industries (Önis, 1991). The role of private actors was mainly to reshape competition between firms in a non-threatening way leading to innovation, whilst being incentivised by the state (Evans, 2011). East Asian DSs are also characterised by the capacity of their public bureaucracies. A common element of bureaucratic capacity is 'meritocratic recruitment' in public sectors, where long-term service is rewarded similarly to positions in the private sector (Evans, 2007). Patrick and Rosovsky (1976) referred to this trait as permanent commitment and proposed that it was one of the contributing factors to Japan's economic success after World War II (Patrick and Rosovsky, 1976).

Evans (2007) argued that the role of the DS has changed in two regards. First, developmental theories have changed and shifted the thinking around development from merely economic growth to that of the expansion of human capabilities, as advanced by Sen. Second, the historical context in which development takes place has changed. During the 20th century the manufacturing sector was the main source of economic growth, but manufacturing jobs decreased globally by 22 million between 1995 and 2002 (Evans, 2007). Towards the end of the 20th century, the service sector became more prominent and growth was generated increasingly through ideas and information (Evans, 2010). Evans (2007) referred to this as a knowledge economy, or the economy being 'bit-driven'.

In the bit-driven economy, as the New Growth theory holds, increased growth and productivity are due to an increased generation of ideas and people's capacity to take advantage of them, specifically through education and training. Abrahams and Goldstuck stated that the onus is on policy makers to accept the challenges presented by the change to the "information-knowledge-based paradigm" (Abrahams and Goldstuck, 2010: v).

2.9.1 Knowledge-based economy

The emergence of the 21st century DS gave rise to the knowledge-based economy. Harris (2001) stated that the knowledge-based economy originated in the 1980s during the recession. As businesses were finding it increasingly difficult to maintain profitability, it became apparent that the recession "marked the beginning of a great new era, the third industrial revolution", which was based on the foundation of newly discovered technologies such as computers, as well as exposed to the benefits of new information technologies (Harris, 2001: 21). The basic assumption of the knowledge-based economy is that economic growth is "created through the creation, production, distribution and consumption of knowledge and knowledge-based products" (Harris, 2001: 22). Ideas and digital software therefore replaced elements such as bricks and cement, characteristic of the industrial economy. In addition, the Internet gave the knowledge-based economy its physical infrastructure that would lend to its expansion. Knowledge, the cornerstone of the knowledge-based economy, was not exposed to the economic principle of diminishing returns as postulated during earlier economic theories. Instead knowledge could be used

boundlessly, without losing its value; it could be kept at no or low cost in a digital format and also keeps its value throughout time (Harris, 2001: 23).

Professor Roy du Pré, chairperson of the South African Technology and Training Platform concurred with Harris and stated in an article that:

> "a knowledge economy, knowledge workers and a knowledge society are all tied to knowledge creation and innovation. Knowledge creation is central to economic growth in any country. The world has moved from a resource base to a knowledge base as the source of wealth" (Burger, 2013).

This does not deem the manufacturing sector as irrelevant; rather, it suggests that the manufacturing sector is no longer the only catalyst for wellbeing or increased employment opportunities. Thus, just as the agricultural sector was replaced by the manufacturing sector as the main impetus for economic growth, so the bit-driven economy has replaced the manufacturing sector (Evans, 2010). The 21st century DS driven by the service sector therefore requires an expansion of knowledge-based capabilities (Evans, 2011). The 20th and 21st century DSs are linked in that the manufacturing sector in the latter DS needs the services sector as a catalyst for job creation and economic growth. Therefore the manufacturing industry needs to diversify to include the services sector (Zalk, 2014).

Furthermore, the shift from a 20th to a 21st century DS does not render the 20th century DS futile. Rather, the 20th century DS is still relevant for economic growth in the 21st century DS (Evans, 2007). However, embeddedness in the 20th century DS needs to be replaced by a more "bottom up" relationship between the state and society in the 21st century DS (Evans, 2011: 310). The 21st century DS needs to include civil society organisations (CSOs) in order to be successful. This is because CSOs are representative of communal knowledge and serve as a guide to efficient resource allocation (Evans, 2007). The notion of embeddedness in the 21st century is thus transformed to include the state, market and society (Evans, 2011). Fritz and Menocal (2007) noted that one of the ways in which transformation of the state can take place is through the improvement and growth of its public services such as health,

education, and agricultural services. They noted that in the case of the East Asian economies, the transformation of states increased opportunities for citizens to partake in the economic growth of the countries (Fritz and Menocal, 2007).

2.10 The role of Information and Communications Technology (ICT)

Previously, the United Nations Commission on Science and Technology for Development Report (1997) could not confirm whether there was a direct link between ICT and development (Ngwenyama, 2006: 3), however recently there has been positive correlation between the role of ICT and development in terms of education, governance, health and other fields. In 2003, a declaration of principles was adopted at the World Summit of the Information Society (WSIS), where member states pledged their commitment to investment in ICT for social and economic development. The declaration stated that it aimed to create an "Information Society, where everyone can create, access, utilize and share information and knowledge, enabling individuals, communities and peoples to achieve their full potential in promoting their sustainable development and improving their quality of life" (Ngwenyama, 2006: 2).

Information is essential for increased developmental outcomes should developmental countries rise to the challenge (Wilson, 2003), as ICT is also viewed as a tool to eradicate poverty and spur growth (United Nations Economic and Social Council, 2000). However, ICT should not be viewed as the ultimate solution to development problems. Those who do not have access to knowledge made available through ICT infrastructure are commonly referred to as information-poor. This creates a new form of poverty, so it is proposed that the lack of access to information should rather be considered as the formation of an additional aspect of poverty instead of viewing ICT as the saving grace to poverty (Wilson, 2003: 6). Nonetheless, ICT remains fundamental in the current global bit-driven economy (United Nations Economic and Social Council, 2000).

ICT capabilities refer to a person's ability to use computer hardware, software and ICT tools (Gigler, 2011). ICT capabilities are further understood in terms of informational capabilities and informational literacy. Zurkowski first used the term 'informational literacy' in 1974 and defined it as the ability to use different sources of information that require various capabilities to ultimately solve problems (Gigler, 2011). Informational capabilities, on the other hand, refer to a person's capability in terms of:

i. ICT capability - the ability to use ICT;
ii. information literacy - the ability to find, process and use information;
iii. communication ability - the ability to communicate effectively with friends, family and colleagues; and
iv. content capability, relating to the ability to share information with society (Gigler, 2011: 9).

It follows that informational capabilities, when analysed in terms of the capability approach, refer to an individual's ability to change their information capital (access to ICT) into real opportunities in society to achieve what they value doing. Thus informational capabilities refer to a person's "positive freedom to use ICTs within the institutional and socio-economic set-up of a society" (Gigler, 2011: 9).

The relationship between ICT and development has also created vibrant debates in terms of the 'digital divide' (Avgerou, 2003: 2). Within this debate, it is argued that developing countries are lagging behind developed countries due to the lack of economic and social opportunities presented by ICT, especially due to inadequate access to the Internet (Avgerou, 2003).

2.11 Chapter Summary

The concept of development has changed over time. In contrast to viewing development solely in terms of GNP as a tool to measure economic development, development now includes concepts related to equity, humanity, and sustainable human development. This

progression ultimately influenced theories of development such as the New Growth theory and the capability approach, which expands development to the production of knowledge and human capabilities. The focus on industrialisation in Japan, Korea and Taiwan forms an important review since the industrialisation process in East Asia gave way to the notion of developmental states. However, as discussed, a progression from the manufacturing to the service sector was noted, which correlates to the shift to a knowledge-based economy. Therefore, current developmental theories such as the New Growth theory and the capability approach prove relevant for the 21st century DS. The following chapter will focus on the research methodologies used to analyse the current state of tertiary institution ICT capabilities.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The previous chapter highlighted the shift in theories of development where development is measured in terms of the state's contribution to the expansion of human capabilities. This chapter therefore explores the research methodologies used to analyse the current state of tertiary institution ICT capabilities, as well as the current policy environment in South Africa and how it is supporting or impeding the development of ICT capabilities at HEIs.

The aim of my research was to assess if and how South African HEIs are contributing to the development of post-graduate students' ICT capabilities. In addition, it aimed to assess the current policy environment that supports or impedes the shift to a knowledge-based economy, characteristic of a 21st century DS.

3.2 Research questions

Through various research methodologies, this research aimed to answer the research question: Are South African HEIs developing tertiary education ICT capabilities?

It also aimed to answer the sub-questions:
i) How do HEIs contribute to the DS?
ii) Is the South African policy environment conducive to the enhancement of ICT capabilities of HEIs?

In order to gather supporting evidence I took a qualitative approach. Denzin draws on the Cochrane Group's definition of qualitative research, which is that it includes a variety of tools such as interviews, participant and non-participant observation, focus groups and other forms of analysis (Denzin, 2009). Cassell and Symon refer to a list of characteristics of qualitative research, which include: "a focus on interpretation, rather than quantification…

flexibility in the process of conducting research, on orientation towards process rather than outcome, a concern with context regarding behaviour and situation as inextricably linked in forming experience; and finally, an explicit recognition of the impact of the research process on the research situation" (Cassell and Symon, 1994: 7). Among the benefits of using qualitative methods is that it enables the researcher to include various methods of data collection techniques for analysis as well as a broad range of theories associated with this type of research method (Guest, Namey and Mitchell, 2013).

3.3 Research scope

The scope of this research was limited to one HEI in the Gauteng province of South Africa - the University of the Witwatersrand (Wits). I chose this HEI due to its accessibility and convenience as I was a student at the university and therefore had access to the participants who formed part of the research.

3.4 Data collection techniques

The main sources of data collection were in-depth, semi-structured qualitative interviews and document analysis. A total of 12 interviews were conducted, which ranged in length between 40 minutes and an hour. The benefit of using semi-structured interviews is that they allowed me to integrate multiple perspectives. Since I interviewed people from different sectors, it also allowed me to gain insight from different interpretations (Weiss, 1995). Semi-structured interviews were conducted with people from the DHET; the Department of Science and Technology (DST); key university personnel from the School of Computer Science and the Faculty of Engineering and Built Environment (FEBE); the eLearning Support & Innovation Unit (eLSI); and Computer & Network Services (CNS). The participants were selected strategically as their experiences in their various departments were deemed essential to the study of capabilities at Wits.

I also relied on document analysis to establish what the South African government is doing regarding the development of ICT capabilities at HEIs. Policy documents by the South African government include, but are not limited to, the National Development Plan (NDP) (2011);

the New Growth Path (NGP) (2010); the National e-Skills Plan of Action (NeSPA); South Africa's National Research and Development Strategy (2002); and the Department of Science and Technology's Ten Year Plan (2008). Other documents included the NPC-ISAD document and various speeches by ANC Members of Parliament (MP), such as former Deputy Minister of Higher Education and Training, Prof. Hlengiwe Mkhize. The documents were analysed and contrasted with evidence from the case study, interviews and Internet searches.

3.5 Case Study

I selected a HEI as a case study to analyse the state of ICT capabilities and the development thereof in order to examine whether tertiary institutions are assisting the country in becoming a DS. Wits was selected as it was the most accessible HEI to me. According to Robert K. Yin, the benefit of using case studies is that it "allows for an investigation to retain the holistic and meaningful characteristics of real-life events" (Yin, 1994). In his earlier work, Yin defines a case study as research strategy that aims to investigate "a contemporary phenomenon in its real-life context when … the boundaries between the phenomenon and context are not clearly evident" (Yin, 1981: 59). The use of various sources of data, is known as the distinguishing feature of case studies, which strengthens the credibility of data collected (Yin, 2003 in Baxter and Jack, 2008), allowing the researcher to combine the data to "illuminate the case" (Baxter and Jack, 2008: 56). It should be noted however, that although the case study approach allows for examination of a problem, the results and conclusions obtained through the various qualitative methodologies, may not be generalised to other universities and thus remains specific to the findings from Wits (Gable, 1994).

Information was gathered primarily from semi-structured interviews and Internet-searches. I analysed specific ICT capabilities that Wits focuses on such as research, the competent use of digital technologies in universities by students, developing and enhancing information literacy, and lastly, the digital and computer literacy of both academic staff and students. I assessed some of these capabilities by looking at e-learning, which was introduced in 2002 when the university adopted a WebCT learning management system (LMS). This was replaced by the end of 2012 when WITS adopted their e-learning platform (University of the Witwatersrand, n.d.). The case study took an expansive view of this migration process and how it has affected staff and students.

3.6 Limitations on Methods and Problems Experienced

(a) Time limits

Due to the time limits I experienced, a smaller group of participants than anticipated was interviewed. Most of the interviewees provided me with useful information, however due to the technicality of the subject matter (ICT) I would have liked to conduct follow-up interviews. Unfortunately, due to the time constraints of the participants and myself, I was unable to do so. In order to grasp the content, I therefore relied on extensive background studies on the subject matter. Most of the interviews took place in venues of the participants' choice, and in some instances the sound quality was poor due to background noises.

There were also challenges with the document analysis. At times, some data such as recent statistics were not available as some governmental departments only publish general data. For this reason, official governmental departments in many instances did not provide a category-specific set of data such as the number of Science, Engineering and Technology (SET) graduates. Further, regarding the statistics provided from Statistics South Africa, I had to tabulate these in order to analyse the state of social services as the website only provided statistics compiled on a yearly basis.

(b) Ethical considerations

I ensured that participants were informed of the nature of the study from the onset of the research. Official documents sent to prospective participants included a 'Participant information sheet', which was accompanied by a request for an interview before participants confirmed their willingness to partake in the research. Participants were also afforded the opportunity to withdraw from the study at any time, as there were no obligations to continue with the research nor were there penalties to withdraw from it. Participants were given the option of remaining anonymous and were assigned pseudonyms to guarantee their confidentiality. In order to ensure my commitment to the participants' confidentiality, I obtained signed statements from the participants indicating their

willingness and understanding of partaking in the study. I believed that these measures assisted in ensuring that the issue of confidentiality was addressed at the very beginning of the interview as it contributed to building trust between the participants and myself (Crow, et al., 2006, in Kaiser, 2009). In order to comply with ethical requirements I obtained consent from the interviewees. The data and conclusions were used for the purpose of the research only, but I informed the participants that I could not guarantee that the results would not be referred to by other parties once the research was published (Punch, 2000).

CHAPTER FOUR: EMERGENCE OF SOUTH AFRICA'S DEVELOPMENTAL STATE

4.1 Introduction

This chapter will trace the emergence of the South African DS. The reader is forewarned that the aim of this chapter is not to establish whether South Africa is in fact a DS, but it rather commences from the viewpoint that it is. This is because the African National Congress (ANC) declared in various documents that the country is indeed on course to build an effective DS. The chapter therefore starts by looking at South Africa's economy before 1994 and argues that the Apartheid state was developmental in a very limited way. It proceeds to look at the post-Apartheid economy, where the ANC was tasked to establish and implement its own economic policies. It also considers the effects of neoliberalism in South Africa.

4.2 South Africa's economy: pre-1994

The developing characteristics of the South African economy can be traced back to diamond mining which commenced around 1867, followed by gold mining in 1886. These ultimately affected South Africa's "accumulation strategy" as the economy was concentrated around mining for the next few decades, followed by the agricultural sector to a lesser degree and then the manufacturing sector (Marais, 2011: 8). Fine and Rustomjee described South Africa's economy as being centred around the Minerals-Energy Complex (MEC) (Pons-Vignon and Anseeuw, 2009). Mohamed agreed that the MEC, which includes the financial and mining institutions related to it, has been at the core of the economy - even at the time of the transition to democracy. This was problematic for the economic structure of South Africa as it not only led to the domination of the mining sector but also contributed to the poorly developed industrial sector. This, in turn, stimulated the growth and development of corporations, infrastructural bases and skills related to the MEC, whereas the unrelated sectors lagged behind (Mohamed, 2007). In fact, by the 1940s the mining sector contributed "between 15 and 30 percent of GDP" and employed almost half a million people. By the

1990s it employed at least 758 000 people, representing almost ten percent of the country's employment sector (Pons-Vignon and Anseeuw, 2009).

Moreover, the Apartheid state supported, financed and supervised parastatal companies such as the Electricity Supply Commission (Eskom) and Sasol. Afrikaner nationalism practiced since the 1930s was reinforced by the National Party's (NP) election victory in 1948. The beliefs incorporated in nationalism promoted the objectives of the upcoming Afrikaner middle class, whilst limiting the social and economic growth of black South Africans (Marais, 2011). The Apartheid state was developmental in that it catered for the development of poor Afrikaners by providing basic needs such as low cost electricity, ensuring the provision of training and skills programmes, and looking after its farmers by providing subsidies for fertilisers (Turok, 2008). In order to strengthen the capitalist Apartheid state, key economic sectors such as mining, agriculture and manufacturing required a perpetual feed of cheap African labour (Marais, 2011: 15 - 16).

Towards the latter part of the 1970s, South Africa's economic policies included many neoliberal features (Marais, 2011: 45). As certain parts of Afrikaner capitalism were 'modernised', the class alliance of the NP, based on the Afrikaner white middle class and small farmers, broke away to form part of the Conservative Party, leaving behind a trail of political implications (Marais, 2011: 45). By 1982, due to the balance of payment crisis, the government conceded to approach the IMF for a loan. The conditions attached to the loan required strict measures at the expense of the black workers. These measures resulted in increased inflation of almost 17% by 1985 through controls such as increased sales tax and the cancellation of subsidies on certain consumer items. Job losses were exacerbated, such that in a span of two years between 1982 and 1984 the metal industry alone lost 84 000 jobs, while the agricultural sector also faced massive retrenchments (Marais, 2011: 46 - 47).

4.3 SA's post-apartheid economy

At the time of its unbanning in 1990 the ANC did not have an economic policy (Marais, 2011: 99), thus while still in exile ANC members primarily used the Freedom Charter of 1955 as a reference point for the party's economic policy. The Charter focused on the nationalisation of various industries, which was confirmed by the then President, Nelson Mandela, who announced upon his release from prison that the party would continue toward the achievement of this goal (Freund and Padayachee, 1998: 1174). However, due to the lack of economic policy formation experience, the ANC had to rely on business people and foreign advisors to guide them through the negotiations that took place between 1990 and 1993 (Marais, 2001: 123; Freund and Padayachee, 1998).

It is for this reason that Padayachee (2005) suggested that the South African post-Apartheid economy needs to be analysed from two viewpoints: first, the high-level of national debt inherited from the then-leading NP (which will not be elaborated on), and second, the inheritance of the ANC-led government's dismal set of basic services for the majority of the population. This stems from the dire need for the provision and improvement of services in various sectors such as health, education, water, as well as power and sanitation infrastructures (Padayachee, 2005: 552).

By 1990 the ANC was ready to create its own set of economic policies, and thus the ANC Department of Economic Policy (DEP) released the *Discussion Document on Economic Policy* (Marais, 2011: 124). At the heart of the document were the issues of “restructuring” the economy and centralising the role of the state in the planning of its industrial strategy. It also emphasised the rectification of previous gender and racial inequalities and the reconstruction of the financial sector. The overall view therefore was “growth through redistribution”, where redistribution was seen as the vehicle that would stimulate growth which would trickle down to meet the basic needs of society (ANC, 1990: 12).

Consequently, the improvement of basic services became an important goal in the Macroeconomic Research Group (MERG) document as well as the Reconstruction and Development Programme (RDP), as the central objective was a "rapid improvement in the quality of life for the poorest, most oppressed and disadvantaged people" (MERG, 1993:2; Padayachee, 2005: 552).

Similarly, the ANC released its 'Ready to Govern' policy document in 1992, which also focused on improving the basic needs of society, reducing unequal growth, and increasing South Africa's international competitiveness (Padayachee, 2005: 554). By March 1994 the RDP was published and set as the ANC's election manifesto for the first democratic elections (Adelzadeh, 1996; Padayachee, 2005). Two important sets of documents influenced the objectives of the RDP, which were the research results of MERG and the Industrial Strategy Project (ISP) (Padayachee, 2005). The ISP is an outcome of the research project by the Economic Trends Research Group, which was tasked by the Congress of South African Trade Unions (Cosatu) to analyse and make recommendations on how to enhance South Africa's manufacturing sector by relooking its industrial policy in order to increase its international competitiveness. Since its establishment in 1985, Cosatu sought the advice of the Economic Trends Research Group. Among the recommendations made in the ISP were trade liberalisation and interventions such as the provision of trade incentives and the development of technology (Freud and Padayachee, 1998).

The MERG document, on the other hand, focused more on demand side measures by looking at how the basic needs of the poor could be addressed and how to develop the economy (Padayachee, 2005). However the ANC did not adopt the MERG document. Freund and Padayachee stated that the policies in the pre-1994 period could be described as innovative and characteristic of a DS (Freund and Padayachee, 1998: 1175).

However the RDP was severely criticised for its contradicting aims of advancing the socialist claims of the party whilst forwarding a neoliberal agenda through its calls for trade and financial liberation (Padayachee, 2005: 555). It was thus argued that the RDP tried to accommodate both economic needs within a neoliberal setting, whilst catering to the needs

of a “social welfare state” within a developmental framework (Padayachee, 2005: 556). In addition, Adelzadeh (1996) was of the view that the RDP White Paper, released during September 1994, differed dramatically from the original RDP, in that the White Paper set a more neoliberal tone as opposed to the original RDP document which took a Keynesian approach. This effectively meant that the main objective was no longer redistribution and the state was no longer the main actor in the economy, but was merely subjected to “managing the transformation” (Adelzadeh, 1996: 67).

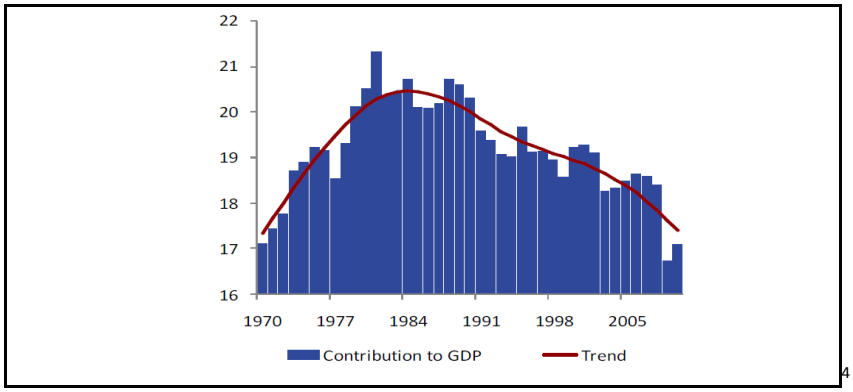
By 1996 the ANC-led government adopted the Growth Employment and Redistribution (GEAR) strategy, which became the focal point of the country's growth and development strategy. Development was referred to in terms of economic objectives through which both “development and reconstruction” could be achieved. Marais stated that the GEAR strategy resembled the Washington Consensus’ neoliberal nature in many ways, therefore whilst it may have been attractive to the business sector, it received criticism from the trade unions (Marais, 2001: 189). Two years into the post-Apartheid state (1996), the economic policy set forth by the ANC-led government was arguably characteristic of promoting class divisions (Marais, 2001: 123). This was in stark contrast to its beliefs as a political party with strong proletariat support, and which had strengthened its alliances with the South African Communist Party (SACP) and Cosatu (Marais, 2001).

4.4 Effects of neoliberalism in South Africa

With the adoption of the RDP after the country's first elections in 1994, it is argued that the liberalisation of the South African economy began as most subsidies for industrial and agricultural sectors were halted, marking the end of supportive policies for the White population (Pons-Vignon and Anseeuw, 2009: 896). However, by 1996 the liberalisation process was intensified with the adoption of the GEAR programme. The fact that South Africa was not coerced to adopt the structural adjustment plan meant for many that the government willingly introduced the structural adjustment plan, thereby limiting the role of the state in economic matters (Pons-Vignon and Anseeuw, 2009: 896).

The liberalisation of the South African economy had many effects, among them the shedding of jobs, increased inflation and the loss of state subsidies for basic consumer goods (Marais, 2011: 45). Pons-Vignon and Anseeuw analysed the effects of liberalisation of the economy on workers in the mining, forestry and agricultural sectors. For the purpose of this paper I will briefly note the effects on mineworkers. Large South African firms and conglomerates moved overseas, which led to an influx of new foreign firms (Pons-Vignon and Anseeuw, 2009: 888). As these companies were occupied with short-lived mining enterprises, they had to restructure the organisation of labour in the mining sector. This resulted in the need to reduce "production costs" in order to increase profits, ultimately leading to the worsening of working conditions (Pons-Vignon, 2009: 889).

As confirmed by Evans, South Africa's economy followed international trends as the services sector became more prominent during the post-Apartheid economy. These changes had already started taking place during the Apartheid era, and have since accelerated. Evidence of this can easily be found by looking at the contribution of the services sector to the country's GDP compared to the contribution of the manufacturing sector (Mohamed, 2007: 83).



[4]

Figure 1: Manufacturing sector's contribution to GDP %

[4] Pan-African Investment & Research Services (2011: 7)

According to the Pan-African Investment and Research Services report, which is available from the Manufacturing Circle website, the South African manufacturing sector's contribution to GDP has been on a constant downward spiral for the last 33 years. The manufacturing sector's contribution to GDP was at its highest recorded levels - 21.3% in 1981. Due to the closed economic system, the other economic sectors' growth was hampered. 1981 also recorded the highest growth rate in manufacturing production, which reached a peak of 9.3% (Pan-African Investment and Research Services, 2011).

However, by the mid-2000s manufacturing output suffered due to not only the global financial recession, but also because of the weakness in the country's macroeconomic policies (Pan-African Investment and Research Services, 2011: 5).

4.5 Where does the notion of a 'Developmental State' come from in South Africa?

The former Minister of Finance, Mr. Trevor Manuel, alluded to the notion of South Africa as a DS during his speech for the Senior Management Service Conference in Cape Town during 2004. Manuel's reference to a DS drew closely on Sen's with regard to the concept of 'Development as Freedom', with Manuel stating that "Sen's concept of removing poverty and tyranny is key, expanding economic opportunities and fighting social deprivation is critical and providing public facilities and services to the poor is paramount" (Ministry of Finance, 2004: 1).

By 2007 the ANC took a more formal approach to introduce the notion of a DS in South Africa, with the leading party referring to a DS during the 52nd National Conference: Adopted Strategy and Tactics of the ANC, which took place in December 2007 in Polokwane (ANC, n.d.). During that same year a Developmental State seminar was held, where Sydney Mufamadi, former Minister of Provincial and Local Government, stated that although consensus still needed to be reached on the characteristics of a South African DS, there was uniformity in the view that development in a South African DS included measures beyond economic growth to include aspects such as poverty, equality and equity, amongst others

(Mufamadi, 2008 in Turok, 2008: 1). Three years later, the National General Council Discussion Document: *Transformation of the State and Governance,* announced that the responsibility of the ANC "is to build a developmental state with the strategic, political, economic, administrative and technical capacity" in its quest to realise the goals of the National Democratic Revolution (NDR) (ANC, 2010: 3).

At first the ANC expressed its understanding of a DS as "an activist state that intervenes decisively in the economy with a generally progressive agenda" (ANC, 2007: 33), however by 2012 it refined its understanding of a DS to "a state that develops the capabilities to guide national economic development through fiscal redistribution, mobilisation of domestic and foreign capital and other social partners, utilisation of State Owned Enterprises (SOEs), industrial policy and regulation" (ANC, 2012b: 15).

The ANC government, however, has been criticised for its intentions behind the adoption of a DS. Marais claimed that the government introduced the notion of a DS in response to their failed structural adjustment policies, i.e. the ANC aimed to place the vision of a DS along with its aspirations of "national liberation" (Marais, 2011: 338). Pillay concurred, stating that due to the inefficiency of neoliberal policies to redress inequalities, both globally as well as in South Africa, the ANC-led government decided to embrace the notion of a DS (Pillay, 2007: 203).

Notwithstanding, it is important to analyse the ANC's understanding of the elements that constitute a DS. First, the leading party envisages a South African DS as one that is "people-centred" and brings about "people-driven change", and like the definitions of a DS that have been noted before, it also looks for economic growth that is sustainable by calling for "socio-economic inclusion" (ANC, 2007: 26; ANC, 2012: 59). Second, a South African DS' organisational capacity is of such a nature that it can accommodate the realisation of a shared vision, calling for the effective facilitation of roles and the implementation of policies among different branches and institutions of government. Third, similar to Marwala's view, the ANC noted that a DS is one whose technical capacity enables it to "translate broad objectives into programmes and projects and to ensure their implementation" (ANC, 2007:

26; ANC, 2012: 59). This would require that public servants in leadership positions have the appropriate skills and training and are able to retain skilled personnel (ANC, 2007: 26; ANC, 2012: 59).

In addition, the ruling party also referred to the South African DS in the 2012 National Policy Conference Document. It stated that a "uniquely South African developmental state", as set out by the Strategy and Tactics document include, among others, the following elements: A state that is efficient in structuring the economy to bring forth increased growth rates and development; and a state that has the ability to implement adequate programmes that will address social issues such as high unemployment rates, poverty and slow or under-development. Lastly, a South African DS is one which has the ability to assemble its masses, with special emphasis on the poor, to free themselves through "participatory and representative democracy" (ANC, 2012b: 15).

Freund (2007: 195), however, argued that South Africa is a "superficial" DS. South Africa has made some progress since the transition to democracy in 1994, such as increased exports of natural products and successful integration into the globalised world in comparison to its neighbours, however it can also be argued that it has fared worse in comparison to other factors, such as the quality of life for the poor. This has not improved despite the numerous attempts to increase service delivery, whilst levels of unemployment are still rife and South Africa's skills levels are also decreasing (Freund, 2007).

I attempted to delve further into the argument above to see whether the government's service delivery attempts have, in fact, been stagnant. By selecting a few indicators such as the adult literacy rate; food access for households that have persons 60 years and/or older; and access to water infrastructure and sanitation, I examined whether the service delivery attempts of the government have positively impacted the quality of life of poor citizens.

According to the data from Statistics South Africa, some service delivery attempts have had a positive effect. These include a decrease in the percentage of households with people 60 years and older that have an insufficient food supply, as it decreased from 7.9% in 2009 to 6.5% in 2012 (Statistics South Africa, 2009; 2010; 2011; 2012). Similarly, the number of people who have no access to water infrastructure also decreased from 1 476 358 in 2009 to 1 330 000 in 2012. However, when analysing the education indicators, it was noted that the adult literacy rate decreased from 19.9% to 16.6% between 2009 and 2012 (Statistics South Africa, 2009; 2010; 2011; 2012). Considering the importance of education for a DS, it seems that while South Africa has reportedly improved some capabilities of its citizens, such as access to water infrastructure, sanitation and food provision for the elderly, it is still struggling to make headway in important sectors such as education.

Development Indicators	**2009**[5]	**2010**[6]	**2011**[7]	**2012**[8]
Adult literacy rates (persons 20 years and older with less than Grade 7 as highest level of education	19,9	19,3	18,2	16,6
% of households with persons 60 years and older with: adequate food access	78,9	78,1	80,8	78,5
% of households with persons 60 years and older with: severely inadequate food access	7,9	8,1	4,8	6,5
# of households with no water supply infrastructure	1 476 358	1 530 000	1 546 000	1 330 000
# of households using bucket toilets	147 062	110 000	79 000	137 000
# of households with no sanitation facility	759 984	728 000	755 000	629 000

Figure 2: Selected development indicators

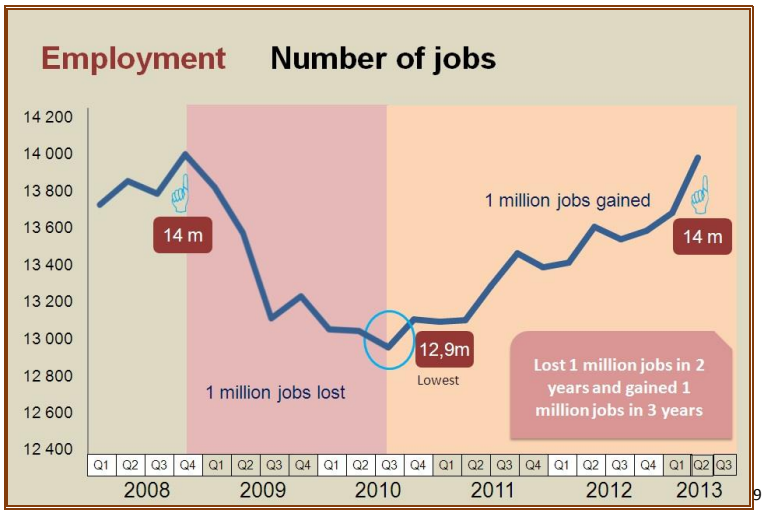
[5] Statistics South Africa, 2009, Statistical release P0318.2

[6] Statistics South Africa, 2010, Statistical release P0318.2

[7] Statistics South Africa, 2011, Statistical release P0318.2

[8] Statistics South Africa, 2014, Statistical release P0318.2

Second, regarding unemployment levels in South Africa, Statistics South Africa reported that the unemployment rate had decreased to levels similar to 2008. It was recorded that the unemployment level for 2013 was at 24.7%, which meant that it had decreased by 0.9% from the previous year. Employment levels were at 14 million, with an increase of 2.3 million jobs, between the fourth quarter of 2008 and the third quarter of 2013 (Statistics South Africa, n.d.), as illustrated in figure 3. However, Kevin Lings, chief economist at Stanlib, cautioned that the Labour Force Survey carried out by Statistics South Africa is not as exhaustive as its census because the sample size used in the latter is much bigger. He also added that "any survey of unemployment has many potential failings" (Lings, 2012: 1).



[9]

Figure 3: Employment levels 2008 - 2013

Furthermore, the quality of South Africa's Science and Mathematics education is considered poor in comparison to many African countries (Freund, 2007: 195). In fact, according to the World Economic Forum's (WEF) Global Competitiveness Report 2013-2014, South Africa is ranked the lowest of all 148 economies listed in terms of the "quality" of these subjects, and rated the third worst on the "quality of the educational system" (World Economic Forum, 2013; 462-463). For this reason, Freund stated that it is not impossible for South Africa to become a DS, but:

[9] Statistics South Africa, n.d.

> "South Africa's prospects as a developmental state rest on overcoming its historic backwardness in terms of education and skills, and its ability to offer a way ahead to many of the people who are now fairly desperate and whose circumstances drag everyone down, indirectly if not directly" (Freund, 2007: 196).

Freund further stated that the problem is not so much with the conception of a DS in South Africa, but rather that its conception is confined. He advised that:

> "…universities and other knowledge institutions need to start focusing on how effective interventions can begin to transform South Africa, to bring a range of important ideas to a wider public, and to allow an interplay between popular forces, the state and autonomous institutions that will place the possibility of a broader vision of a developmental state on the agenda" (Freund, 2007: 197).

Bodibe argued that what is necessary for a South African DS is the ability of government to diversify the economy, thereby focusing on industries that can create mass employment opportunities, improve the living standards of the majority, and ultimately also increase South Africa's export base (Bodibe, 2008: 215). Turok agreed and argued that a South African DS would need to focus on addressing the inequalities in "social and economic infrastructure" (Turok, 2008: 162). In addition, the government needs to create employment in the "second economy", where the benefits of the South African economy are yet to reach those in the underdeveloped areas. This is because the notion of a "trickle down" economy is false, as the benefits from the formal economy will not simply reach the underdeveloped in the second economy (Turok, 2008: 162-3). It is unlikely that the problem of inequality will disappear or be solved on its own. What is required from a DS is for the state to strategically intervene through political power (Turok, 2008: 168).

4.6 Chapter summary

This chapter started with the viewpoint that South Africa is a DS. Considering the ANC's definition of a South African DS, through my literature review I found that while it seems that South Africa has reportedly improved some capabilities of its citizens, such as access to water infrastructure, sanitation and food provision for the elderly, it is still struggling to make headway in the education sector. With special emphasis on Mathematics and Science, it was found that South Africa is rated the third worst in terms of the quality of these subjects in our educational system (WEF, 2013: 462-463), therefore if South Africa is indeed positioning itself as a capability-enhancing DS, where the abilities of its citizens enhances economic development, it would need to address the provision of these capabilities as they proved imperative to the original DSs of East Asia.

The next chapter will consider South Africa's knowledge economy and ICT. As noted in Chapter 2, the DS of the 21st century operates in an era where growth is propelled through knowledge and idea production.

CHAPTER FIVE: SOUTH AFRICA'S KNOWLEDGE ECONOMY AND ICT

5.1 Introduction

This chapter will analyse South Africa's knowledge economy and ICT. It will look at its gross domestic expenditure on research and development (GERD), its business expenditure on research and development (BERD) levels, and its expenditure on R&D in comparison to other developing countries. It will also consider the lack of critical skills and the reasons these shortages exist. Lastly, it considers various ICT policy documents and strategies to determine the status of the ICT environment in HEIs in South Africa.

For the purpose of this paper I considered the definition of Research and Experimental Design (R&D) by the Frascati Manual: "Research and Experimental Development (R&D) is creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of humanity, culture and society, and the use of this stock knowledge to devise new applications" (HSRC, n.d.).

Abrahams and Goldstuck contributed several characteristics of bit-driven economies, of which only two were noted for consideration:

(a) Enhancement of R&D and innovation

I considered the expenditure on GERD in order to assess whether South Africa has increased its efforts in R&D. During 2007 – 2008 South Africa's GERD levels exceeded USD2.4bn or 0.93% of GDP (DST, 2009: 3; DST, 2013: 8-11, in Abrahams and Goldstuck, 2010: 3). This is low when compared to the expenditure by BRICS countries such as China and India, which have invested above 1% of their GDPs respectively (Abrahams and Goldstuck, 2010). During the period between 2007 and 2009, the GERD increased steadily by 13.0% or R2.4 billion, as the GERD recorded in 2008/09 was R21.0 billion compared to R18,6 million in 2007/08 (DST, 2011). The GERD, however, experienced a sharp decline during 2009/10 of R86 million,

where the expenditure amounted to R20.955 billion (DST, 2013: 3). Therefore the GERD declined progressively from 0.93% (2007/08) to 0.92% (2008/09)[10], further declining to 0.87% (2009/10).[11] However these statistics cannot be viewed in isolation as the decline of BERD levels also decreased by 9.7%, while R&D in higher education increased by 4.3% and R&D in science councils increased by 1.5% for the last recorded results (2009/10). These increasing levels of R&D were, however, insufficient to sustain the GERD rate (DST, 2011).

When I considered South Africa's expenditure on R&D as a percentage of GDP I found that South Africa fared much better than many of the other developing countries, yet when compared to advanced economies, South Africa lags behind East Asian countries such as Japan and South Korea. These countries, among others, achieved GERD rates of above 3% for the period up to 2009 (DST, 2013). Nonetheless, South Africa seems to be making a worthy contribution to the global output of R&D expenditure, reaching almost 0.4% in 2008. South Africa can also boast of its various national scientific research councils, national research facilities, and universities that have a strong presence in the research field (Abrahams and Goldstuck, 2010: 3).

(b) The ability to deliver leading "human capital as a supply side factor in knowledge-intensive production" (Abrahams and Goldstuck, 2010: 3)

Although South Africa has noteworthy policy frameworks that are supportive of its innovation efforts and goals, these are insufficient to overcome the current challenges caused by the increasing need to supply human capital. For example, South Africa, in comparison with its BRICS partner Brazil, only produces 1.4 researchers out of "every 1 000 employees in South Africa (0.14%)", whilst Brazil produces at least 2.2% and Russia produces a staggering ratio of 6.4%. This may make South Africa less appealing than their BRICS counterparts when R&D projects are considered (NACI, 2011/2012: 8).

[10] (DST, 2011)

[11] (DST, 2013)

The challenges in human capital expansion are exacerbated by the limitations in the education and training sectors. At least 40% of the population aged between 18 and 24 are unemployed or do not partake in any formal education or training programmes (NACI 2011/12: 8). Furthermore, South Africa's ability to retain post-school students, considered to be between 20 and 24 years old, is only 19%. These are among the factors that exasperate South Africa's under-utilised engineering sector. In 2012, the Minister of Higher Education and Training, Dr. Bonginkosi Emmanuel "Blade" Nzimande, stated that South Africa has only one engineer for every 3 100 persons in the country's population (South Africa Government Information, 2012).

The number of tertiary education graduates has increased, thereby leading to South Africa's expanding human resource base (NACI, 2009: 6-18). However South Africa needs to increase its full-time researchers and post-doctoral graduates in the ICT sector. During 2005 there were only 1 176 doctoral graduates (Abrahams and Goldstuck, 2010: 4), which increased slightly to 1 274, or 26 doctorates for every one million people in South Africa, in 2007. However, most of these graduates were white males (ASSAf, 2010: 16). The DHET stated in its latest report that doctoral degrees increased to 1 421 in total from all 23 public HEIs, while the total pool of Master's degrees increased to 8 633 in the same year. It does not specify the exact statistics from the SET field, although it does state that the majority of graduates and diplomas were from the SET sector (DHET, 2013: 20-21).

Studies indicate that South Africa produces between 23 and 27 PhDs per million of the population per annum and would need to increase this to 6 000 per annum, of which half would need to be from the SET sector, in order to partake in the knowledge economy (ASSAf, 2010; NRF, 2011-2012). According to the former Minister of Science and Technology, Derek Hanekom, there was a 36% increase in the number of PhD graduates between 2008 and 2011 from 1 576, which may have increased to 1 700 doctorates in 2012 (Polity, 2013).

Engineering is one the scarce skills in South Africa, according to Minister Dr. Nzimande, thus South Africa needs to produce more engineers, specifically technicians and engineering technologists. The DHET noted that there are various challenges that may hamper the efforts to increase the number of graduates in the engineering fields to 15 000 per annum by 2014 (South Africa Government Information, 2012). South Africa is still lagging behind in the production of graduates in the said field since it slightly increased between 2009 and 2011 from 8 424 to 9 387. This was still well below the goal of 10 093 for 2011 (Esterhuizen, 2013). The target of 15 000 per annum therefore seems impossible to reach, considering that the DHET admitted that the engineering science graduates increase by only 1.78 per annum (South Africa Government Information, 2012).

5.2 ICT at HEI in SA

South Africa does not have a coordinated ICT policy in HEIs, resulting in only some of the 23 state-funded universities having programmes or strategies related to ICT**.** However, according to Participant 6, the DHET is currently in the process of working on it (Interviewee 6, personal communication on 2 October 2013). South Africa's policies and strategy documents acknowledge the shift from a 20th to a 21st century DS, therefore emphasising the need to shift towards a knowledge economy. The following policies and strategies were assessed: the NeSPA; South Africa's National Research and Development Strategy 2002; Ten-Year plan *Innovation towards a knowledge-based economy 2008 - 2018*; the NGP and NDP.

The government has also created several initiatives such as the Information Society and Development (ISAD), spearheaded by former deputy-President Thabo Mbeki in 1996 and then in 2001, which ultimately led to the establishment of the Presidential Commission on the Information Society and Development (PNC on ISAD). The role of this Commission was to address South Africa's development challenges and increase its economic competitiveness (Farrell and Isaacs, 2007).

NeSPA emerged from a two-year consultative process hoping to enhance South Africa's participation in the “Information Society and Creative Knowledge Economies”, alternatively known as Knowledge Society (DoC, 2010). The Department of Communications (DoC)

established the e-Skills Institute (e-SI), which aimed to develop the country's ICT abilities so that it can overcome its challenges. e-SI focussed on the following e-skills in line with the NeSPA key areas: employment readiness of graduates; socio-economic development which should in turn lead to more investments in ICT; and lastly, R&D. The capabilities that will be enhanced through the NeSPA are e-skills, which include e-literacy skills aimed at the unemployed and unskilled youth (DoC, 2010).

South Africa's National Research and Development Strategy (2002) highlighted the pivotal role of Science and Technology in realising South Africa's participation in the global knowledge economy. The strategy is based on the White Paper on Science and Technology (1996). The main actors identified in the strategy are the DST, Government, Science Councils, higher education and the private sector, which will work together to achieve two main goals: boost economic growth and improve "quality of life" (The Government of the Republic of South Africa, 2002: 9). These will be achieved mainly through the R&D capacities of students and researchers. The R&D strategy will focus on innovation which will require expanding biotechnology and ICT, however South Africa still relies on imported technologies and its R&D in the ICT sector has mostly been in the software field (Abrahams and Goldstuck, 2010). For this reason it needs to strengthen its R&D innovation capacity to develop local technologies (The Government of the Republic of South Africa, 2002).

The country will also look at SET human resources and transformation; in addition to enhancing R&D skills, it seeks to increase the number of Science and Engineering graduates, especially women and previously disadvantaged groups (The Government of the Republic of South Africa, 2002). The DST established the South African National Research and education Network (SANReN) in 2003, which was implemented by the Council for Scientific and Industrial Research (CSIR) through its Meraka Institute (Meraka Institute, n.d.). Its operational activities are officially handled by the Tertiary Education and Research Network (TENET) (SANReN, n.d.).

SANReN serves as the government's tool to develop cyber-infrastructure to strengthen R&D in public research institutions and universities, ensuring that South African researchers are able to contribute to global knowledge production. Through this initiative universities and research institutions will connect at a speed of 10 gigabits per second (Gbps) (DHET, n.d.). Phase one of the project has already been completed, connecting 105 tertiary institutions to SANReN, while phase two is being extended to rural universities and satellite campuses around the country (van Rijswijck, 2012).

The DHET has announced that the DST will invest at least R886 million into linking local universities and public research organisations (van Rijswijck, 2012). In 2010, the DST and the DHET jointly contributed a further R150m for the SANReN project (DHET, 2012). In 2008 the DST released a Ten-Year Plan - *Innovation towards a knowledge-based economy* - where it admitted that only through the production and commercialisation of knowledge can South Africa experience economic growth (DST, n.d.). It put forth four criteria to achieve a knowledge-based economy: the development of human capital; the creation of knowledge (R&D); investment in knowledge infrastructure; and shrinking the innovation gap between the results that are produced by research and the outcome it has on society and the economy. It further addressed the need for high-end human capital that is both qualitative, referring to the increase in the production of knowledge; and quantitative, referring to the number of PhDs (DST, n.d.).

The Ten-Year Plan thus seeks to increase the numbers of ICT engineers and scientists, as well as ICT research and production. As noted in the previous chapter, during 2005 South Africa produced almost 1 200 PhD graduates of whom 561 were from the SET sector. This means that between 1999 and 2003 South Africa produced 0.05 PhDs per 1000, which is well below leading knowledge economies such as Australia, South Korea and Japan. Thus in order for South Africa to compete in the international knowledge economy, it needs to increase its production to about 3 000 SET PhDs (DST, n.d.).

The government has asserted its commitment to creating a DS in various policy documents, such as the NGP (2010) and the NDP (2011). The NDP is the outcome of the Diagnostic Report released by the National Planning Commission (NPC), which was appointed by President Jacob Zuma in 2010. The Commission's diagnostic report, released in 2011, highlighted several issues that are responsible for limiting the country's achievements. The overall objective of the Plan is to alleviate poverty and reduce inequality by 2030 by enhancing capabilities of citizens and the state. Indeed, the Plan takes a Sen approach as it states that "…capabilities and the opportunities that flow from development enable individuals to live the lives to which they aspire" (NPC, n.d.). Among the six inter-connected priorities is "building a capable and developmental state" (NPC, n.d.: 6). A DS, according to the Plan, is one which enhances the capabilities of its citizens so that they may improve their lives, whilst addressing the injustices of the past (NPC, n.d.). The specific capabilities which the Plan seeks to enhance are education, skills and the creation of employment opportunities (NPC, n.d.).

Higher education contributes to economic development but also enriches quality of life. Universities therefore play a key role in developing a country as they provide the relevant education and skills for employment, create new knowledge and set the standards for a country's knowledge capital. The government's goal is to produce at least 5 000 PhDs per annum by 2030 compared to 1 420 in 2010. In order to reach this goal, the Plan states that the country should produce at least 100 PhDs per million every year by 2030 (NPC, n.d.).

In addition, the NDP seeks to create 11 million jobs by 2030, which will be achieved through skills enhancement in the labour sector. The NGP, on the other hand, aims to create five million new jobs by 2020 (NPC, n.d.), focusing particularly on the knowledge intensive green economy. In addition it also aims to create 100 000 new jobs in the knowledge-intensive sectors of ICT and higher education, especially R&D (Natrass, 2011). Regarding the emphasis on ICT, the PNC-ISAD report also noted that there is currently a shortfall of 165 000 ICT students to sufficiently address the lack in ICT skills, whilst it was estimated in 2008 that South Africa had a shortage of at least 70 000 IT professionals (Mitrovic, Sharif, Taylor and Wesso, 2011). The report states that universities are focusing more on producing ICT lecturers and professors than technicians (PNC-ISAD Report, n.d.).

However, it has been stated that South Africa is unable to take advantage of the creation of at least 25 000 “potential jobs a year” due to government's under-spending by 30 percent. In order to reach the goal of 11 million new jobs by the end period of the NDP, private sector investment into South Africa needs to increase to 20 percent and government investment should increase by at least 10 percent, as noted previously in chapter 2. (Fin24, 2013).

In addition, Coleman stated that the NDP’s target of 11 million jobs is unrealistic and unsustainable, as 90 percent of jobs or 9.9 million jobs created would be through SMMEs, yet during the last decade SMMEs have not had a major increase in job creation, thus the job opportunities that do arise will be low-paying and low-quality jobs (Coleman, 2013). Lings also cautioned against the unrealistic target of obtaining 11 million jobs as the economy would need to grow between 5% and 7% per year. He argued that with 500 000 youth entering the employment market per year the economy would need to grow at a much faster rate (Lings, 2012); the GDP for the third quarter of 2013 was 0,7% (Statistics South Africa, 2013).

There are contradicting arguments regarding the NDP and NGP’s focus on the manufacturing versus the services sector. Some argue that the NDP, unlike the NGP, does not consider the importance of invigorating the industrialisation sector, where manufacturing still makes a contribution to growth, albeit a shrinking one. The Plan forecasts that the manufacturing sector's contribution to job creation will shrink to 9.6% from 12% in 2010, and jobs created through the service sector will increase by five million jobs or 40% by 2030 (NDP, n.d.). The NDP’s prediction, I believe, clearly speaks to the government’s realisation of the shift from a 20th to a 21st century DS, and that more jobs will created by the service sector.

Although South Africa does not have a coordinated ICT policy in HEIs, there are a few collaborative ITC projects such as the African Virtual Open Initiatives and Resources (AVOIR) Project, headed by the University of the Western Cape (UWC). Its aim is to create educational and business opportunities for Africa's development through Free and Open Source Software (FOSS) development activities (Farrell and Isaacs, 2007: 4). Sakai SA, on the other hand, is a collaboration between the University of Cape Town (UCT), the University of

South Africa (Unisa) and North-West University, and serves as an extension of the Sakai Collaboration and Learning Environment (CLE). Sakai is an association of 100 HEIs which aims to develop an open source collaboration and learning (CLE) environment. Sakai SA seeks to increase capacity development through initiatives such as the Programmer's Café[12] (Farrell and Isaacs, 2007). The constraint to promoting ICT in HEIs is the related costs, especially in addressing access to resources and national priorities. Universities are allocating more resources to ICT-related activities, however not uniformly, which raises the issue of unequal access for students. This further creates a social divide around class, race, gender, nationality and disability. These divides reinforce the exclusion of previously disadvantaged groups within the ICT sector (Council on Higher Education, 2007).

5.3 Chapter summary

South Africa's policies and strategy documents acknowledge the shift from a 20th to a 21st century DS, therefore emphasising the need to move towards a knowledge economy. Regarding South Africa's participation in the knowledge-based economy, I found that the country's BERD decreased, thereby influencing the reduction in GERD from 0.93% during 2007/08 to 0.87% in 2009/10 (DST, 2011, 2014). South Africa's expenditure on R&D as a percentage of GDP is low in comparison to advanced economies (DST, 2013). Further, there is insufficient production of skilled labour, especially in the Engineering field (South Africa Government Online, n.d.). The challenges in human capital expansion are exacerbated by the limitations in the education and training sectors (NACI 2011/12: 8), and South Africa needs to increase its production of researchers as it is very low in comparison to its BRICS partners (NACI, 2011/2012). The next chapter is a case study which analyses the development of tertiary education ICT capabilities.

[12] Sakai is described in more detail in the following chapter.

CHAPTER SIX: UNIVERSITY OF THE WITWATERSRAND (WITS) CASE STUDY

6.1 Introduction

This chapter considers the development of post-graduate ICT capabilities at Wits and how this contributes to the DS of South Africa, specifically focusing on the capabilities of ICT preparedness and research. In order to understand how these capabilities are developed, it is first necessary to get an overview of the operating systems at the university.

6.2 Overview of Wits[13]

During 2010, the university had five faculties and approximately 27,934 registered students (University of the Witwatersrand, n.d.). The university has accomplished some remarkable achievements and is one of the only two African universities that are listed as top institutions globally in two different international listings. It is also the only HEI in South Africa that is included in the world's top one percent "in seven defined fields of research according to the 2007 ISI international rankings" (University of the Witwatersrand, n.d.). Wits contends that it is a university which is focussed on research and achieving academic eminence (University of the Witwatersrand, n.d.), thus it is no surprise that it hosts at least "20 South African Research Chairs, seven research institutes, 20 research units, 10 research groups, six Centres of Excellence, and more than 200 rated scientists, of which 16 are A-rated" (University of the Witwatersrand, n.d.). It also boasts of receiving the most financial contributions among the universities in South Africa, which includes international donors (University of the Witwatersrand, n.d.).

To analyse Wits' impact I looked at its technological make-up, as that assists with the development of post-graduate students' capabilities. The ICT capabilities were analysed in terms of the Wits 2013 Strategic Framework.

[13] For a brief history of Wits, refer to Appendix A.

6.3 ICT preparedness

The first capability, IT preparedness, was assessed by looking at the technological advancements of two units: the Computer & Network Services (CNS) and the eLearning Support & Innovation Unit (eLSI). In order to establish if and how these two units are contributing to the enhancement of students' ICT capabilities, I analysed the technological advancements made by the university.

Dimension Data, a leading ICT services provider, and Wits have partnered to upgrade the bandwidth across the university's campuses through the Inter Campus Link Upgrade (ICLU) project. The aim of this project is to ensure that all the campuses have efficient and reliable access to bandwidth. Wits prioritises its research activities and realises the importance of technological innovations in order to create a supportive environment for its academics and staff. Professor Yunus Ballim, former Wits Deputy Vice-Chancellor (Academic), stated in an online article that "research, teaching and community engagement is not possible at a modern university without access to reliable ICT infrastructure" (Itweb, 2012: para 3). The ICLU started in the beginning of 2012 and will expand the ICT infrastructure to increase connectivity in residences from Braamfontein to Parktown (Wits, 2012).

Amongst the priorities to enable the university to reach the status of one of the best 100 global universities is that of increasing its efforts to become "an IT Savvy University" (Wits, 2011b: 5). Under this priority, the university will garner its efforts to incorporate the usage of advanced technology across all its main academic processes for both its staff and students. Pursuant to this, the university will also adopt advanced technological pedagogy to address contact challenges, which will complement the use of the traditional tutorial-based teaching approach (Wits, 2011b).

a) CNS

The CNS unit at Wits is responsible for shared services of the university such as email and networking systems, finance and human resource systems, and student management and elearning services. Mr. Xolani Hadebe, who has a dual role of Deputy Director and Director, is responsible for ensuring that the unit functions optimally. It is fitting to note that his background of an Honours degree in Computer Science, a Teachers Diploma as well as his MBA from Wits Business School, assists him to engage and relate to the needs of students, lecturers and the university in general. The unit consists of approximately 96 employees which include Java programmers, call centre operators, technicians, network engineers, project managers, business analysts, and so forth. It is for this reason that Mr. Hadebe describes it as an "IT shop" (X. Hadebe, personal communication, 11 November 2013).

CNS, as part of its responsibilities and core functions, does not involve itself in the development of students' capabilities, however it provides the platform for the university to do so. Lecturers inform the CNS of what their needs are and the CNS accommodates those (X. Hadebe, personal communication, 11 November 2013).

b) SIMS

The Student Information Management System (SIMS) is used for managing student information through People Soft technology (X. Hadebe, personal communication, 11 November 2013). Wits migrated from the Oracle Student System (OSS) to SIMS[14] due to three types of benefits: functional, organisational and managerial. The functional benefits of the new system include faster registration time and more efficient resource distribution (Wits, 2012: 99), while the organisational and managerial benefits include enhanced decision making, improved service delivery and strengthened relationships between the lecturers and administrators. These benefits will ultimately contribute to the university's aim of attracting more of the best students in the future (Wits, 2012).

[14] This migration process will be described in more detail later in the chapter

However, according to Interviewee 4 at the School of Computer Science, Wits has not made the best choices when purchasing IT from other countries. The general consensus among staff at Wits is that “nothing works ... not one of the IT systems that we have is working” (Interviewee 4, personal communication, 16 September 2013). Interviewee 9 agreed that the move to the new system has been troublesome, however they were of the view that the migration, which occurred in 2013, was just having teething problems. Interviewee 9 cautioned that the time lapse between the selection, implementation, training, and use of the system was too long, for instance by the time most of the staff had become familiar with the then-new system (in this case Oracle), it was already time to change to the new system - SIMS. While this challenge is related to the fast pace of technological improvement, Interviewee 9 also noted that it may be related to the need to increase funding (Interviewee 9, personal communication, 11 November 2013).

Some of the challenges experienced by Interviewee 9 were the constant “bugs in the system”, where some data of students was omitted completely, while in other cases the information of the student did not correspond with the student's actual data (Interviewee 9, personal communication, 11 November 2013). The problem may be related to administrative matters, as issues seem to be prolonged over extended periods when a current Vice Chancellor’s term ends and a new Vice Chancellor is appointed. It was established that the issues in IT-usage are addressed with the joining of the new Vice Chancellor and “the person's first task will be to sort out IT at Wits, so that it can support the work of academics as supposed to obstructing it” (Interviewee 4, personal communication, 16 September 2013).

c) The Migration Process to LMS

SIMS was established after a study was authorised in 2007 which found that an “open source Learning Management System (LMS)” would be beneficial to Wits. By 2008, an additional study looked into the practicability of the previous propriety services and open source alternatives (Wits, 2011c: 5). In 2010 the Senate ICT Reference Committee took a decision to examine the selection of the university's LMS (Wits, 2011c). By 2011 it was decided not to renew the University's WebCT licence and a Working Group was tasked to

consider the most feasible non-propriety LMS. The Working Group ultimately selected between three different open source systems: Kewl/Chisimba, Moodle and Sakai (Wits, 2011a: 5; 2011c: 6).

Mr. Rabelani Dagada, Acting Head of the eLSI, led the Working Group, which was responsible for overseeing the selection of the LMS system. The members of the Working Group consisted of various faculties, thus lending knowledge and insight from diverse departments such as, but not limited to, the Library, CNS, eLSI, Science, Engineering and the School of Education (Wits, 2011c: 5). One of the selection criteria for the LSM was the capacity to strengthen the University's pedagogical doctrine, where the pedagogy informs the technological needs of the university and not vice versa. Another important criterion was that the LSM should enhance the innovativeness of the pedagogy and the improvement of software. Considering these criteria the LSM would need to be stable, but more importantly, it had to demonstrate an ability for innovation (Wits, 2011). The final selection was between Sakai and Moodle, where the former proved to be more advantageous and suitable for the university. Sakai's undeniable existence in the field of Higher Education also contributed to its selection (Wits, 2011a).

Over 200 global educational institutions use Sakai, most of which are based in the USA, followed by Europe and Great Britain. From the top ten universities as listed in the *Times Higher Education 2010-2011 World University Rankings*, seven use Sakai, and out of the Top 100 universities in the same listing, at least 77 use Sakai. In South Africa, most of the active users are from the University of Cape Town (UCT), the University of South Africa (UNISA) and North-West University (NWU). These universities are working on creating a tool that does not need Internet connectivity in order to address the issue of expensive bandwidth in South Africa (Wits, 2011c). It is not surprising, therefore, that the Working Group stated that:

> "Sakai presented the most evidence based on its focus on higher education, it's systematic approach to pedagogic support in higher education, and its proven functionality at peer universities, including many that are on the Top 100 in the World in terms of rankings, as well as many in Africa" (Wits, 2011c: 12).

Blackboard or WebCt, the system Wits used previously had several limitations due to it being propriety software, for instance it could not be customised to the needs of individual universities. It also did not allow for universities to link up with one another, thereby limiting universities' ability to make or recommend immediate changes. Therefore universities were welcome to write to the software developers and recommend certain changes, but that took several months or even years, and in the event that the university did require changes, it did not necessarily correlate to the needs of other universities, according to Mr. Dagada (R. Dagada, personal communication, 12 November 2013).

Sakai, on the other hand, is not owned by any one party, and welcomes universities and other users to make changes as and when required. This, benefits all other users as they are free to use the changes recommended (R. Dagada, personal communication, 12 November 2013). eLSI's team leader, Ms. Fatima Rahiman, concurred that as various universities are using Sakai, there is the benefit of contributing to a pool of skills and thus Sakai is directly responsible for the enhancement of ICT skills (F. Rahiman, personal communication, 12 November 2013). It also saves developers from laborious manual tasks; whereas the eLSI unit would need a developer to manually load students' names and basic information over a long period of time, with Sakai, students are able to log into the system and update their basic information automatically (R. Dagada, personal communication, 12 November 2013).

d) eLSI

The eLSI team consists of 17 permanent, contract and intern workers. The objective of the unit, as described by Mr. Dagada, is to help students and staff to use the ICT available at the university, not only effectively but also innovatively in their "teaching and learning" methods (R. Dagada, personal communication, 12 November 2013).

The unit has four components:

- The instructional design team which is responsible for the pedagogical aspects, thereby assisting with the online teaching methods;

- A team that deals with content learning, assisting academics to structure the content in a particular way;
- The software development team; and
- The research team, who works on usability testing and applied research, amongst other activities.

Amongst the achievements to date eLSI can boast that it currently has more than 1,700 courses online (F. Rahiman, personal communication, 12 November 2013), as well as various assessment tools such as Respondus and Mindjet, as well as a plagiarism detection tool, Turnitin (eLSI, n.d.). These components work together to enable the most effective usage of technology in the educational arena; help develop students' and staff's capabilities in computer and digital literacy; promote an increase in usage of educational resources that have interactive capabilities, and assist in the participation of research activities (University of the Witwatersrand, n.d.). One such example is Skills Zone, a module for online tutorials developed by eLSI in conjunction with the South African Institute for Distance Education (Moll, Adams, Backhouse and Mhlanga, 2007). This module is still in the piloting phase but aims to develop the computer literacy of first-year students. (F. Rahiman, personal communication, 12 November 2013).

The eLSI, according to Ms. Rahiman, has various projects in their pipeline such as a "Wits marketplace", similar to application houses such as Google Play (F. Rahiman, personal communication, 12 November 2013). The "Wits marketplace" will house all the applications of the university and students will be able to download these onto their mobile phones (F. Rahiman, personal communication, 12 November 2013). Once the "marketplace" has been created and is ready for use, the team will have to address the critical issue of content dissemination and the various ethical considerations involved (F. Rahiman, personal communication, 12 November 2013).

Although eLSI does not assess students' digital and computer literacy skills due to a lack of resources, they do offer training for these skills. According to Interviewee 2 of the eLSI unit, the Science faculties require that students obtain a Computer Competency certificate. eLSI provides the training for this and students are able to do the assessment off-campus. Once the resources are obtained eLSI will look into providing assessments on-campus, which will be tailored according to the specifications of the different faculties (Interviewee 2, personal communication, 12 November 2013).

The unit has made great strides in a short space of time, however it faces many challenges. Like most departments in universities, it is constrained by limited financial resources. Although it has been funded by the DHET since 2010, from 2014 it may be funded by Wits itself, thus competing for funding with the other units at the university. The fact that the university is willing to fund the unit speaks volumes of the impact and potential that it has, and according to Mr. Dagada "is a step in the right direction" (R. Dagada, personal communication, 12 November 2013).

The unit does not lack physical resources and their working space is conducive for their tasks at hand, however eLSI is working hard to increase the number of academics who use the system, as less than half use elearning. Although eLSI will need more resources, Mr. Dagada seems inspired by the challenge. He believes that if he and his team work hard to provide quality elearning services, both staff and students will be able to see the value added and his job to raise funds will be much easier (R. Dagada, personal communication, 12 November 2013).

6.4 Research

As noted in the beginning of the chapter Wits prioritises research, as articulated in its 2013 strategy paper which claims that it aims to be a "leading research intensive university" (Wits, 2011b: 2). The Wits 2013 strategy document speaks to their Vision 2022 Strategic Framework (Wits, 2011b). Given the central role of research, the Research Development

office is key as it is in charge of facilitating research for the entire university. It reports to the Deputy Vice Chancellor (DVC), and the role of the office, according to Dr. Drennan is "to develop, facilitate, (and) support research, across all faculties and disciplines" (R. Drennan, personal communication, 11 November 2013).

The university aims to enhance its technology in order to assist its researchers to perform and produce internationally competitive research. One of the targets related to this vision is the university's objectives under the banner of 'Research and Knowledge Leadership' (Wits, 2011b: 4), which is "basically... to try and empower people to do the right thing and become more research savvy" (Drennan, personal communication, 12 November 2013). The objective is to draw top scholars ("ISI highly cited/ A-rated researchers") (Wits, 2011b: 9) because "once you bring in the best they can pull a lot of the younger researchers as well and turn these into researchers that produce research of international quality" (R. Drennan, personal communication, 11 November 2013). The milestones to achieve this objective are as follows:

a) Increase Wits' National Research Foundation (NRF) A-rated researchers from 16, as measured in 2010, to 30;

b) Increase the number of researchers that are NRF-rated to 450, compared to 221 during 2010 (Wits 2011b). Interviewee 8 of the FEBE stated that his/her department puts great effort into encouraging students to become NRF-rated (Interviewee 8, personal communication, 12 November 2013). The faculty alone currently has 27 NRF-rated academics, of which ten are from the School of Chemical and Metallurgical Engineering (Wits, 2012).

c) Double the number of its research chairs from 15 during 2010 to 30 (Wits, 2011b)

The second and third objectives focus on doctoral and postdoctoral completions and attractions respectively. Regarding the intensification of the completion rates of PhDs, the university is focusing on improving the research environment to help increase research output by establishing supportive organisations, systems and resources that will be able to sustain it, as well as addressing the needs of a strategy for research infrastructure (Wits,

2011b). Interviewee 8 confirmed that the School of Chemical and Metallurgical Engineering is trying out different methods to enhance research activities in their department for post-graduate students, which have yielded some results. For example the school does its best to inform students of various research grant and funding opportunities, as well as collaboration opportunities in government departments (Interviewee 8, personal communication, 12 November 2013). These efforts have led to the school's improved publication rate, where it delivered 66 journal papers during 2012 (Wits, 2012) compared to 61 journal papers in the previous year (Wits, 2011). This is also due to the assistance of the Research Department at the university, which has been communicating upcoming events and areas of opportunities from the NRF and others (Interviewee 8, personal communication, 12 November 2013).

The school also encourages students to apply for different research funding opportunities, even though students may be reticent about applying since there are no guarantees that the funding will be approved. Furthermore, the School of Chemical and Metallurgical Engineering is also in the process of establishing a database which records what major pieces of equipment already exist in the faculty so that others do not to purchase the same equipment, with the pre-requisite that the equipment is not heavily used. (Interviewee 8, personal communication, 12 November 2013).

Another goal under the banner of 'Research and Knowledge Leadership' is to improve the quality, increase the quantity, and widen the impact of the research output, whilst simultaneously enhancing the research capacity at the university (Wits 2011b). So far, Wits' FEBE, according to Interviewee 8, is doing exactly that by not only supporting its students, but also by employing staff who have the ability to do research and "get(ting) the papers out, but also importantly, a lot of the staff is bringing in their own funds" (Interviewee 8, personal communication, 12 November 2013). The FEBE increased its research output units by 65% from 118 to 195 between 2010 and 2011 (as reported in 2012), and also had a substantial increase in the subsidy received[ii] (Wits, 2012). The staff supplements the subsidies received with the funding they attract from various agencies, in addition to the funding obtained by the Centre for Research Excellence through the NRF (Interviewee 8, personal communication, 12 November 2013).

The Faculty of Science also improved its research outputs for three consecutive years, from 419 in 2010, to 508 in 2011, and 608 in 2012, showing an improvement of 45% (Wits, 2012). This is partly due to the support of the Research Development office, which encourages the development of peripheral skills of researchers, especially in the Computer Science department. A development programme assists scientists with writing their funding proposals as well as with planning their research projects, thereby informing them how to "maximise their published output" in order to raise their academic profile (R. Drennan, personal communication, 11 November 2013).

The university aims to attract increasing levels of postdoctoral fellows and programmes; one way to achieve this is to increase the levels of funding for these. However, it is important to note that the university is not only focusing on increasing the quantity, promising a sharp increase from 48 in 2010 to 200 by the completion of this Vision strategy, but also the quality of postdoctoral fellows, aiming to attract at least 1.5 globally renowned publications per year (Wits, 2011b). This clearly speaks to the influence and drive of the new Vice Chancellor (VC), Professor Adam Habib, according to Interviewee 9, as the interviewee is of the view that "...with the new VC there's a new drive to get the best to Wits" (Interviewee 9, personal communication, 11 November 2013).

Another goal is to attract the finest international post-graduate students and to provide students with an internationally renowned educational experience. Milestones related to this goal and my research were as follows: the university aims to escalate PhD enrolments from a 1 230 headcount in 2010 to 2 000 within three years in order to strengthen the university's capacity for research and other scarce skills (Wits, 2011b). In addition, the university will also focus on evening out the responsibilities of supervisors; and will introduce a "retiree mentorship programme" in order to augment the staff's mentorship abilities for PhD students (Wits, 2011b).

6.4.1 Wits' Achievements in Research

One of the highlights for the Department of Research was the establishment of the Centre for Learning, Training and Development (CLTD), which was created to assist with the development of its staff. Through the efforts of Dr. Drennan and with the support of CLTD, various workshops were held for the development of research, and the number of workshops has increased dramatically (R. Drennan, personal communication, 11 November, 2013).

Another key achievement is the NRF unit, which has been making great strides in securing funding for emerging academics such as pre-doctoral and doctoral students. Even though applications are considered on a competitive basis, Wits is able to assist academics to obtain funding through the NRF by assisting them with the drafting of their funding proposals, gaining better insight into the programme, and once funding is obtained, advising academics on how to spend their grants wisely. The Research and Development unit is now perceived among the academics at the university as a "helpful and supportive function", so much so that the Director of the Research and Development unit, Dr. Drennan, goes out to meet with researchers in their space instead of having them come to his office to obtain the necessary advice and counsel (R. Drennan, personal communication, 11 November 2013).

Research has gained more prominence at the university under the current VC, Prof Adam Habib. Because of his drive, requests for the achievement of the Research and Development unit's goals are easily accommodated, aiding the realisation of the university's overall aim to become the best (R. Drennan, personal communication, 11 November 2013).

6.4.2 Wits' Challenges in Research

Although remarkable achievements have been made with regard to the research goals set by the university, it nevertheless still faces many challenges. I have focussed on the challenges of one department in particular, the FEBE, where a few issues have been raised. First, however, there are several challenges which are not specific to any department. An

example is the difficulty in obtaining funding for research, which can be described as a common challenge. Second, academics face time constraints when writing a winning proposal (Interviewee 9, personal communication, 11 November 2011).

Regarding the challenges that face the FEBE, the following have been noted. Although Interviewee 8 is lucky in that s/he does not have a heavy teaching load, other lecturers do and this impacts their research efforts. Further, the FEBE has insufficient lab space. There are reportedly some researchers who do not have lab space at all, and those that are not doing sufficient research can be penalised. This is due to a rule that exists amongst schools, even within the FEBE, that

> "you have to do a certain amount of teaching to get a research space, and if you are taken on and you don't do that teaching than you're not entitled to research space, which is absolutely ridiculous, given that we are supposed to be a university that is trying to push research" (Interviewee 8, personal communication, 12 November 2013).

This rule, however, is not implemented fairly amongst staff at the school. The school has many South African Research Chair Initiatives (SARChI), which are supposedly recommended to have a teaching load of 5 percent, therefore if this rule was enforced unilaterally then the SARChI would not be allowed to have lab space but they do (Interviewee 8, Personal communication, 12 November 2013). The SARChI had 21 chairs when it was established in 2006 which has increased to 152 chairs, across various fields such as Natural and Physical Sciences, the School of Humanities and Engineering (DST, 2013). The aim of SARChI is to provide support in terms of skills development to the research community with the objective of increasing research output (DST, 2013: 2).

Interviewee 8 admitted that there have been some positive outcomes amidst the challenges at the school even though the university is limited in terms of funds, the school is privileged to have the most lecturers, which was a deliberate and wise decision. There has to be a

balance between the schools in terms of how many lecturers each school has and the fact that this school has the highest number of lecturers allows it to conduct more research. However, some lecturers are often frustrated by the obstacles they face, such as the lack of adequate lab space, which hinders their ability to conduct research (Interviewee 8, personal communication, 12 November 2013).

The School of Computer Science at Wits aims to educate the future leaders, business people, critical thinkers and innovators. According to the Wits website, Computer Science focuses on "solving problems and using computers to solve problems effectively" (University of the Witwatersrand, n.d.). Computer Science graduates learn about "software, operating systems and hardware technology", but the most important capability according to the school is the ability to use computers and solve problems encountered on a daily basis (University of the Witwatersrand, n.d.). The school also places emphasis on producing research, and therefore advocates that its lecturers be knowledgeable about the latest developments in the discipline, as well as ensuring that the university develops a research programme that is committed to advancing the skills of its post-graduate students (University of the Witwatersrand, n.d.).

The School of Computer Sciences had at least 334 Honours students, 122 Masters students (by coursework and research), 361 Masters students (by research only) and 335 PhD students enrolled during 2012 (Wits, 2012). The school does not seem to have any physical infrastructure challenges or shortcomings, but the areas that need improvement lie within the management sector, as well as increasing its capacity to deal with the pressure it supposedly receives from government (Interviewee 4, personal communication, 16 September 2013).[15] As with the FEBE the School of Computer Science also experiences the burden of a lack of funding, thus it is less able to attract and/or maintain top staff; staff prefer to go to other universities such as UCT which offer more competitive salaries. Should staff in the Computer Science field choose to stay in South Africa, i.e. they choose not to emigrate for much higher salaries, they often move to the private sector for its lucrative

[15] These will be addressed shortly.

opportunities as compared to the opportunities offered in academia (Interviewee 4, personal communication, 16 September 2013).

Regarding the senior management at Wits, there seems to be a high turnover with acting/heads of departments, and Interviewee 4 stated that during the past decade they may have had up to six different heads or acting heads, which presents a challenge for lecturers (Interviewee 4, personal communication 16 September 2013). Moreover, management at universities, in general, are believed to be pressurised to water down the courses in the first year of study within the School of Computer Science by doing away with the difficult, though important, courses. In this school, Interviewee 4 stated that the course on formal languages was replaced with much easier courses such as computer literacy. This leads to increased registrations of first year students in the field of Computer Science, ultimately maintaining the façade of an increased number of Computer Science students. The important courses that are at the crux of the Science become "optional" courses at post-graduate level, and students who do not choose these subjects will never know what they entail and how to use the skills related to these subjects in the world of work. This is tied to the issues of obtaining subsidies, as well as keeping up appearances that the university is actually producing more graduates in the related field (Interviewee 4, personal communication, 16 September 2013).

However, Interviewee 5 from the DHET contended that universities are tasked with informing the DHET of their enrolment plans, that is, what faculties they will be focusing on, the number of graduate and post-graduate students they target, and so forth. The DHET, according to Interviewee 5, encourages universities to focus enrolments on fields such as engineering, physical and health sciences, engineering technology and teacher education, as these areas have proven to be the most challenging in South Africa. In a way, the DHET does highlight the ICT sector, although not directly. Interviewee 5 further stated that universities are encouraged by the DHET to focus on their niche areas, that is, the strong points of the university. After collating the data from all public universities, a report is generated which identifies the profile of graduates and post-graduates that will be produced, should universities meet their targets. It is only then that the DHET will step in and recommend to

some universities that there needs to be an increased focus on certain fields in order to address an imbalance of skills needed by the country. This is based on an enrolment period over six years, where a review is done midterm in order to assess whether universities are meeting their targets. This is imperative as meeting the targets indicate whether funding from the DHET will be obtained (Interviewee 5 , personal communication, 2 October 2013).

Thus there seems to be some correlation between the views of Interviewee 4 from Wits and Interviewee 5 from the DHET, in that when universities meet their targets, they obtain funding from the DHET. However, the difference of opinion is based on whether the DHET compels universities to change the content of their courses, referring specifically to the Computer Sciences field in this case. Interviewee 5 from the DHET did confirm that they do recommend that universities alter their focus to include other fields should their targets indicate an overemphasis in certain academic fields, in order to address the lack of critical skills (Interviewee 5, personal communication, 2 October 2013).

Interviewee 9 in another department also raised the issue of subsidies, albeit in a different light to Interviewee 4 from the School of Computer Sciences. Interviewee 9 believed that universities' subsidies from the DHET are influenced by the number of post-graduate students, the university's publication record and their student output. Interviewee 9, however, was cautious to note how much this impacts the university's subsidy. The participant believed that there are additional factors that influence the subsidies received by a university, such as whether it is a previously disadvantaged institution, and therefore the formula used by the DHET remains unclear and it is imperative not to speculate. In addition, the university may not necessarily be pressurised to get subsidies from the DHET as the value of the subsidies changes from year to year due to factors such as inflation (Interviewee 9, personal communication, 11 November 2013).

In order to reach some consensus on these opposing views, a view from a senior official at the DHET described the issue of subsidies in the following way. When the DHET started the policy of funding, the Department made a specific amount available to fund higher

education and training for the purpose of incentivising "research productivity, both in terms of Masters, PhDs and in terms of publications" (Interviewee 5, personal communication, 2 October 2013). In order to allocate funding appropriately, the Department set up norms that would instruct the allocation of resources. Thus, should an institution meet those norms, they "would get paid outputs and institutions that weren't meeting those norms would get research development funds" (Interviewee 5, personal communication, 2 October 2013). By 2011, however, the vast amount available through the research development fund was depleted due to the increased levels of research production, thus the Department had to change their funding policy in order to accommodate the needs of everyone. For this reason they started:

> "top slicing the fund to enable a research and development fund to be made available to institutions that are not very well research active or that do not have high levels of staff with Masters and PhDs so that they can still draw on those funds in order to work on those aspects. And the rest of the system can draw their outputs from that fund" (Interviewee 5, personal communication, 2 October 2013).

In fact, the official from the DHET stated that the funding from the Department is estimated at about R2.6 billion (Interviewee 5, Personal Communication, 2 October 2013). Although I did not reach an exact configuration of the formula used that determines subsidies to universities from the DHET, it seems that a formula does exist and it supports the research and development imperatives characteristic of a knowledge economy. In fact, according to Interviewee 5 the higher education system, at both graduate and post-graduate level, is an important aspect of the shift towards a knowledge economy. The critical issues for this shift include "access to higher education studies, the development of research and the capability of our institutions" (Interviewee 5, personal communication, 2 October 2013). It seems the reality is that there will always be a need for increased sources of funding.

Nonetheless, by watering down the courses, especially in the first year of study, the School of Computer Sciences can now claim that it is producing more graduates and thus "it looks much better politically", rather than producing a lesser number of graduates (Interviewee 4,

personal communication, 16 September 2013). Tied to this issue is the apparent lack of understanding of what Computer Sciences is by both the management at the university and by government. According to Interviewee 4, some:

> "seem to think (that) Computer Science is if you know how to use (software) packages (but) those are just skills. Computer Science is actually a Science, which means it is often difficult to get through to them" (Interviewee 4, personal communication, 16 September 2013).

Therefore, there needs to be a common understanding and acceptance that students who are accepted as first-year students into the school should have displayed good mathematical capabilities in high school. On the contrary, it seems that due to pressures discussed above, students are accepted with less than satisfactory matriculation marks[16] (Interviewee 4, personal communication, 16 September 2013).

Due to these shortcomings, what will the impact be on South Africa's ICT sector? Interviewee 4 seemed to think that it has already affected the industry. The Interviewee concurred with Abrahams and Goldstuck (2010) that South Africa, as noted previously, is a net importer of technology. Further, people (in South Africa)

> "just buy software...and adapt it more or less to the local market. They will go overseas to do the actual development work (there)... (thus) we will keep on being consumers instead of developers" (Interviewee 4, personal communication, 16 September 2013).

[16] The status of South Africa's Mathematics and Science education has been discussed in detail in Chapter 5, but the effect of this will be analysed in the concluding chapter.

The School of Computer Sciences also emphasises strengthening of research capabilities, both verbal (communication) and written. During Honours levels students have to complete a research methods course, and as part of the course they have to deliver a series of presentations as well as a written report. According to Interviewee 4, this has an advantage over international universities, as students have claimed that when they attended universities in the USA or Canada, they found that their research methods course gave them a tremendous advantage over the other students; “it seems to be a valuable course” (Interviewee 4, personal communication, 16 September 2013). This is supported by the fact that post-graduate students admitted that they could not learn these capabilities in their personal capacity and are of the view that this course was one of the best courses (Interviewee 4, personal communication, 16 September 2013).

6.5 Chapter summary

Through qualitative semi-structured interviews I found that the various departments that deal with the ICT requirements of the university are coordinated and work well together, however departments have very different challenges. One department that has fared increasingly well is the Research Development office, which has propelled the level of research production and output across various schools. Unfortunately, some departments such as the FEBE lack physical resources such as lab space. Moreover, it seems that rules for academics and staff are not implemented universally, resulting in feelings of being treated differently. Apart from the emotional experiences, it also prevents some lecturers from conducting research activities as they have to barter for research space. The School of Computer Sciences, on the other hand, faces challenges with regards to the level of Mathematics and Science capabilities of entry-levels students, as well as pressure from the university which reportedly results in the DHET directing them to ‘water-down’ courses in order to make the subjects easier for students. The aim of this process is allegedly to increase the number of Science graduates at the university.

CHAPTER SEVEN: CONCLUSION AND RECOMMENDATIONS

This chapter draws on the body of the research paper to conclude the findings. The research has aimed to assess if and how South African HEIs are contributing to the development of post-graduate students' ICT capabilities, which are necessary for a 21st century DS. Further, it aimed to assess the current policy environment that supports or impedes the shift to a knowledge economy, characteristic of a 21st century DS. After summarising the findings of the research question, I will conclude this chapter with recommendations to the government.

Research question: Are South African HEIs developing tertiary education ICT capabilities?

In order to address this question, I looked at one South African HEI, Wits, as a case study. The experiences of the university cannot be generalised to all 23 HEIs in South Africa. However, the findings from the case study is illustrative of the capacity of Wits and may thus serve as an example to other institutions where lessons may be drawn and criteria improved upon or followed. I narrowed my focus to two ICT capabilities: ICT preparedness and research, and found the following:

ICT Capability

In order to assess this capability, I looked at the functions and impact of two units at the University: the CNS and eLSI. I also assessed how the migration process from the Oracle Student System (OSS) to SIMS affected lecturers. Although the aim of this research was not focused on lecturers' ICT capability, it has been demonstrated through various interviews that it has an impact on lecturers' ability to be efficient and effective.

The CNS unit, as part of its responsibilities and core functions, does not involve itself in the development of students' capabilities. However, it does provide the platform for the university to do so (X. Hadebe, personal communication, 11 November 2013).

The eLSI unit's objective is to help students and staff to use the ICT resources innovatively during teaching and learning processes (R. Dagada, personal communication, 12 November 2013). The various tools that eLSI offers enable the staff and students to develop their computer and digital literacy as well as research capabilities (University of the Witwatersrand, n.d.). I found that the eLSI does not assess students' ICT capability directly; according to Interviewee 2, they do assist students to obtain the training for these literacy skills so that they can obtain a Computer Competency certificate, which is required by the Science faculties at the university. Once the resources are obtained, eLSI will look into providing assessments on-campus and this will be tailored according to the specifications of the different faculties (Interviewee 2, personal communication, 12 November 2013).

Therefore I found that the eLSI unit lacks the resources to expand their input to post-graduate students' development of ICT literacy, but they do assist undergraduate students to obtain these skills. Should the unit secure more resources there is a possibility that it may increase their effectiveness to reach a wider capacity of students, and ultimately affect a broader range of ICT capabilities at the university.

In order to assess the effectiveness of the new SIMS system and whether the university achieved the desired objectives, I found it difficult to reach a conclusion as the participants I interviewed had different experiences with the new system. Interviewee 4 at the School of Computer Science was of the view that Wits had not made the best choices when purchasing IT from other countries. The participant believed that a general consensus exists among staff that "nothing works ... not one of the IT systems that we have is working" (Interviewee 4, personal communication, 16 September 2013).

In contrast, although Interviewee 9 concurred that that the move to the new system has been troublesome, the participant also stated that the migration is part of teething problems and it should get better in time. Moreover, Interviewee 9 cautioned that the time lapse between the selection, implementation, training, and use of the system is too long. Participant Interviewee 9 did, however, experience a few problems where some students'

The data on the system were either deleted or did not correlate with the actual data. The participant narrowed this issue down to administration problems, but is confident that the new VC is focused on addressing the IT-usage issue speedily and effectively in support of academics (Interviewee 9, personal communication, 11 November 2013).

Due to the varying views from the interviews I could not assess whether the SIMS system enhanced or impeded lecturers' and administrators' ICT preparedness. As noted previously, lecturers' and administrators' ability *per se* was not meant to form part of the study. However, I deemed it interesting to note since the Participant interviewed has a direct impact on the knowledge output of academics and students at the university.

Research

The second capability I measured was research. Similar to the first capability, I relied on evidence from my case study. Given the central role of research, I discovered that the Research Development office is crucial to the enhancement of research efforts at the institution because it is in charge of facilitating research for the entire university. The role of the office, according to Dr. Drennan, is "to develop, facilitate, (and) support research, across all faculties and disciplines" (R. Drennan, personal communication, 11 November 2013).

I found through my interviews that the Research Development office fulfilled this purpose, not only to academics, but to its staff as well. For example, the university has established the CLTD to assist with the development of its staff. The Research Development office and the CLTD have held various workshops to aid with the development of research, the number of which have increased dramatically (R. Drennan, personal communication, 11 November, 2013).

I also found that the research imperative has been strengthened through the establishment of the NRF unit. The achievements of this unit not only include securing funding for emerging academics, but also assist with administrative duties which are crucial for academics to secure funding. These duties performed by the NRF include, amongst others, the drafting of their funding proposals, helping academics gain better insight into the programme, and advising academics on how to spend their grants wisely (Interviewee 9, personal Communication, 11 November 2013).

Wits claims that as an institution it is focussed on research and achieving academic eminence (University of the Witwatersrand, n.d.). Through my interviews I discovered that the Director of the Development Research office, Dr. Drennan, goes the extra mile to assist researchers by travelling to their research space instead of having the academics visit him in his office to obtain the necessary advice and counsel. This is one of the contributing efforts that has led to the Research and Development Office being perceived among the academics at the university as a "helpful and supportive function" (R. Drennan, personal Communication, 11 November 2013). However, Dr. Drennan would rather attribute the increased prominence of research at the university to the influence, drive and passion of the current VC, Prof Adam Habib. Dr. Drennan believes that the Research Development's office is able to perform so well because with Prof. Habib at the helm, requests for the achievement of the Research and Development unit's goals are easily accommodated, which helps with the realisation of the university's overall aim to become the best research institution globally (R. Drennan, personal Communication, 11 November 2013).

The university has also committed itself to increasing the research output rate by improving the research environment. Through the interviews I conducted, I found that a productive synergy exists between the various research facilitation legs, in particular the NRF, the Research Development office, and the Schools. For instance, the efforts made by the School of Chemical and Metallurgical Engineering has improved the publication rate to 66 journal papers in 2012 (Wits, 2012) from 61 the previous year (Wits, 2011). This is not only due to the efforts by the school to inform researchers of available grant and funding opportunities, but is also due to the assistance from the Research Department to communicate

information from the NRF and others (Interviewee 8, personal communication, 12 November 2013).

Through document analysis I found that the Faculty of Science has also improved its research outputs for three consecutive years, showing an improvement of 45% (Wits, 2012). The university was able to achieve this due to the support of the Research Development office, which encourages the development of peripheral skills of researchers, especially in the Computer Sciences department. A development programme assists scientists with writing their funding proposals and planning their research projects, thereby informing them on how to "maximise their published output" in order to raise their academic profiles (R. Drennan, personal communication, 11 November 2013).

Although these measures described above are important to illustrate the capacity of the research capability at the university, the actual staff who have the abilities to do research and "get(ting) the papers out" are imperative (Interviewee 8, personal communication, 12 November 2013). The staff is therefore a beneficial and important criterion that augments the university's research capability.

Therefore in order to conclude the argument on the research question: **Are South African HEIs developing tertiary education ICT capabilities?,** the evidence provided above indicates that Wits indeed enhances the ICT preparedness and research capabilities of their students and academics. The university has taken decisive measures to do so, and there is a distinctive synergy between the Research Departments, the Schools, the NRF office and the supportive units such as the CNS and eLSI who take heed of the needs of lecturers and students. However, as mentioned in Chapter 3, the conclusions drawn from the case study may not be generalised to the entirety of HEIs in South Africa. Nonetheless, it does illustrate the capacity and universities to enhance students' ICT capabilities.

Sub-question 1: How do HEIs contribute to the Developmental State?

The 21st century DS operates in a knowledge-based economy, driven by an expansion of human capabilities. Proponents of the New Growth theory argue that idea production serves as a catalyst for growth (Evans, 2007). HEIs are therefore critical to the success of DSs, as universities are the central outlet for research, whether it is basic or applied research. By ensuring effective post-graduate research programmes HEIs allows for a greater share of patenting productivity (Stern, Porter, and Furman, 2000: 25, in Gardner, 2002: 25).

Furthermore, post-graduates in the research field have the ability to work in both public and private R&D institutes. The impact of these research and development outputs permeate into the local economy, thereby "transforming technical bases of agricultural and manufacturing production" (Gardner, 2002: 25). Through my case study I found that Wits has shown some progress towards its goal to improve the quality, increase the quantity and widen the impact of the research output, whilst simultaneously enhancing the research capacity at the university (Wits, 2011). As stated by Interviewee 8 in the FEBE, Wits contributes by not only supporting its students, but by actually having the staff with the appropriate advanced capabilities to do so. Further, many of the staff in FEBE take initiatives to attract additional funding for research (Interviewee 8, personal communication, 12 November 2013). These efforts have resulted in increasing research output units by 65%, from 118 to 195 units between 2010 and 2011 (as reported in 2012), and also led to a substantial increase in the subsidies received (Wits, 2012). HEIs therefore form a critical part of the knowledge-based economy, which is reliant on the creation and dissemination of new knowledge, leading to growth in countries' economies as well as that of individual companies and communities (Cortright, 2001: 1).

Critical skills shortage

The East Asian DSs focused on building a strong investment environment by investing in the necessary infrastructure and human capital. This led to a "strong capital base and a highly skilled labour force" (Bodibe, 2008 in Turok, 2008: 215). HEIs supplied the states with the

necessary skills demanded by a growing labour force, created new knowledge and set the standards for each country's knowledge capital.

Yet through my document analysis I found that South Africa has been unable to produce the required number of engineers. The DHET noted that there are various challenges that may hamper the efforts to increase the number of graduates in the engineering fields to 15 000 per annum by 2014 (South Government Information, n.d.). South Africa is still lagging behind in the production of graduates in the said field since it slightly increased between 2009 and 2011 from 8 424 to 9 387. This is still well below the goal of 10 093 for 2011 (Esterhuizen, 2013). The target of 15 000 per annum therefore seems impossible to reach, considering that the DHET admitted that the number of engineering science graduates increases by only 1.78 per annum (South Government Information, n.d.).

Sub-question 2: Is the South African policy environment conducive to enhance the ICT capabilities of HEIs?

The ANC defined a DS as "a state that develops the capabilities to guide national economic development through fiscal redistribution, mobilisation of domestic and foreign capital and other social partners, utilisation of State Owned Enterprises (SOEs), industrial policy and regulation" (ANC, 2012b: 15). If one takes a capability approach to analyse the ICT policy environment, one would ask whether the government is providing the necessary supportive environment to allow sufficient resources to meet tertiary students' capabilities, since the leading party has stated in its policy documents that in order to be a DS, one of its requirements would be to meet the capabilities of its citizens.

South Africa does not have a coordinated ICT policy for HEIs, resulting in only some of the 23 state-funded universities having programmes or strategies related to ICT. This is despite ample evidence in governmental policies that stresses the importance of ideas and innovativeness in a knowledge-based economy. Of the 23 state-funded universities, only some have programmes or strategies related to ICT (Farrell and Isaacs, 2007). However, according to Interviewee 5, the DHET is currently in the process of formulating a

coordinated policy for ICT in HEIs (Interviewee 5, personal communication on 2 October 2013).

Through the various documents that I analysed in Chapter 5, I found that there is overall agreement on the importance of ICT skills augmentation for the shift towards a knowledge economy.

Recommendations

A 21st century DS invests in its citizens' capabilities, such as education. Although this does not necessarily increase available employable opportunities (Amsden, 2010), it does give the opportunity to its citizens to live the lives they choose. Sen's capability approach draws on what development entails, which is the process of expanding a person's actual freedoms (Sen, 1999). When I considered the state of education in South Africa, particularly in Mathematics and Science, I found that the quality was considered to be worse in comparison to many African countries (Freund, 2007). This begs the question whether the country will be able to supply the necessary professionals for its labour force in the future. As Nelson and Phelps stated, education is an investment in people's capabilities, and thus educated citizens become the conveyers of human capital (Nelson and Phelps, 1966, 75).

My first recommendation would be that the government increases the level of Mathematics and Science skills from primary school through to high school, so that students may have a better grasp of the Sciences or Mathematical fields in tertiary education. More importantly it exposes more students to the field, thereby increasing their capabilities to live the lives they desire. Whether these students wish to act on those capabilities, i.e. whether they actively choose the Sciences or Mathematical fields at tertiary level is not the objective, as the state would have at least offered them the means to do so.

My second recommendation is that government should diversify the economy and lessen its dependence on mineral resources, thereby focusing on other industries that can create mass employment opportunities; improve the living standards of the majority; and ultimately also increase South Africa's export base (Bodibe, 2008 in Turok, 2008: 215). As Turok stated, in order for South Africa to become a DS, it will need to address the inequalities across societies and races (Turok, 2008: 162). In addition to addressing the socio and economic imbalances, the government needs to create employment in the "second economy", where the benefits of the first economy are yet to reach those in the underdeveloped areas. This is because the notion of a "trickle down" economy is misleading. Turok postulated that the benefits from the formal economy will not simply reach the underdeveloped in the second economy, and the supposed "ladders of advancement" between the formal and second economy are a false notion as "the gap is too wide" (Turok, 2008: 162-3).

Thus the government would need to implement a programme that addresses a shift in thinking of government officials, which will hopefully be accompanied by "re-prioritisation in national, provincial and local government" priorities (Turok, 2008, 163). It is unlikely that the problem of inequality will disappear or be solved on its own. What is required from a DS is for the state to intervene strategically through political power (Turok, 2008: 168).

Should the government implement these recommendations, I believe that it may truly live up to Mkandawire's definition of what development entails, which is to enhance people's capabilities, alleviate human suffering and increase people's choices (Mkandawire, 2011: 9). The state may also become a true DS that understands that development occurs through prioritising economic growth, coupled with structural changes in the production system (Castells, 1992: 56-57, in Jomo and Fine, 2005: 103).

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APPENDIX A: Brief History of Wits

The University of Witwatersrand or Wits' history can be traced back to 1869 when the South African School of Mines was established in Kimberly and thereafter moved to Johannesburg. It became known as the Transvaal University College in 1906, and later the South African School of Mines and Technology. The College was incorporated as the University of the Witwatersrand when it was given full university status in 1922. It had approximately 1,000 students across the six faculties (University of the Witwatersrand, n.d.).

APPENDIX B : List of Interviews

1. Dagada, R. Head of eLSI. University of the Witwatersrand. Interviewed on 12 November 2013.

2. Drennan, R. Director: Research Development. University of the Witwatersrand. Interviewed on 11 November 2013.

3. Hadebe, X. DD: Computer & Network Services. University of the Witwatersrand. Interviewed on 11 November 2013.

4. Interviewee 2. eLSI. University of the Witwatersrand. Interviewed on 12 November 2013.

5. Interviewee 4. School of Computer Science. University of the Witwatersrand. Interviewed on 16 September 2013.

6. Interviewee 5. DDG. Department of Higher Education and Training. 02 October 2013.

7. Interviewee 8. Faculty of Engineering and Built Environment. University of the Witwatersrand. Interviewed on 12 November 2013.

8. Interviewee 9. The University of the Witwatersrand. Interviewed on 11 November 2013.

9. Maredi, I. The Department of Science and Technology (DST). 17 September 2013.

10. Rahiman, F. Team leader: learning design, ELSI. Interviewed on 12 November 2013.

11. Schofield A. JSCE. 12 November 2013.

12. Williams, Q. Meraka Institute at the council for Scientific and Industrial research (CSIR). 27 September 2013

APPENDIX C: Participant Information Sheet

TITLE OF STUDY: South Africa's Emergent Developmental State and the Challenges of Capabilities Development - Are Universities at the cutting edge of ICT?

Invitation to participate

My name is Cindy Snyders and I am a Masters student at the University of the Witwatersrand (WITS). I would like to extend an invitation to you to participate in a research study. Therefore please take some time to read the participant information sheet which will address a few key aspects, for you to know before you commit to partake in the study. After having read the information provided, and you are still unclear, please do not hesitate to ask me to clarify.

What is the purpose of the study?

The purpose of this study is to have a better understanding of South Africa's developmental state. More specifically, I would like to find out which ICT capabilities are necessary for a 21st century developmental state. As stated in numerous governmental documents, the government is committed to creating a knowledge economy, job creation, and improve capabilities of its students and workforce. Thus, I am interested in researching which capabilities are being developed in South Africa, but specifically focusing on the role of ICT capabilities at Higher Education Institutions (HEIs) and how that can contribute to South Africa's developmental state.

Why have you been selected to partake in this study?

You have been chosen as a candidate for interviews or focus groups due to your professional career or tertiary studies, your expertise in either the developmental field, ICT field, science and technology field, or through my Internet research and/other referrals.

Is participation voluntary?

Participation in this study is completely voluntary. You may withdraw from the study at any time.

What will happen if you take part in this study?

All interviews and focus group discussions will be tape recorded. If you agree to partake in the study, you will be given an audio recording consent form. The purpose of using a tape recorder is that I may quote what you say as accurately as possible. However, if you do not wish to have the interview recorded, you are free to not to sign the form. In such case, I will rely on handwritten notes.

What are the possible risks and/or disadvantages of taking part in this study?

Due to the nature of this study, it is possible that some participants during interviews or focus group discussions you may not want to reveal the source of the information. As this might be a concern, all the data collected in this study will be kept in the strictest confidence. Further, your identity will be protected in the final report through the use of a pseudonym. Also, please be aware that I will not discuss any information gathered through interviews with other participants.

What are the possible benefits of taking part in this study?

Your participation in this study may have long-term benefits for the development of ICT capabilities at South African universities, and may in turn influence South African policy makers' efforts toward further investment in the ICT sector of tertiary educational institutions in South Africa.

Will your participation in this study be confidential?

All information collected for this study will be kept in confidence. In the resulting research report, participants during the interview process may wish to remain anonymous. In such case, you will not be identified by name and thus you will be quoted by a pseudonym. Any information that could be used to reveal your true identity will not be used. Every effort will be made throughout the research process to ensure that your identity remains anonymous.

What will happen to the results of this study?

The data collected from this study will be used in a research report towards a Masters Degree and for possible scientific journal publications.

Who has reviewed this study?

The study has been reviewed and approved by the Human Research Ethics Committee (HREC) of the University if the Witwatersrand.

Should you have any questions, kindly contact me or my supervisor:

Cindy Snyders: snyders.cindy@gmail.com; Dr. Vishwas Satgar: Vishwas.Satgar@wits.ac.za

Thank you

Cindy Snyders

_____

APPENDIX D: Participant Consent Form

I AGREE to participate in an interview as part of the study on ''South Africa's emergent developmental state and the challenges of capabilities development" by Cindy Snyders.

I confirm that I understand: *(Please put tick if you agree or **a cross if you disagree**)*

What participation in this research project means	
That my participation is voluntary	
That I have the right not to answer any questions I don't feel comfortable with	
That I have the right to withdraw from the study at any time	
That the information I share with the researcher will be kept in strictest confidence	
That every effort will be made to ensure my identity remains anonymous	
That I have the right to be named if I do **not** want to be anonymous	
That information I give during the interview will not be shared with other participants	

Date: _____

Participant name: _____

Participant signature: _____

APPENDIX E: Audio Recording Consent Form

Please tick the relevant option

- o I AGREE to my participation in in-depth interviews to be recorded using an audio recording device.

- o I AGREE to my participation in focus group discussions to be recorded using an audio recording device.

I am fully aware that the recording device will be used to record what I say during my participation in this study. I also understand that the audio recording will later be transcribed and may be used in the final research report.

Date: _____

Participant name: _____

Participant signature: _____

[i] As the statist theory evolved over time two deviations formed under the theory. The continuity thesis, believed that the rise of Korea's developmental state was because of a "gift of history" whilst the statist discontinuity thesis, the other more mainstream deviation explained its rise as a "break with the past". Nonetheless, both schools give credit to the state's dominance over the capitalist sector (Chibber, 1999, p.313).

[ii] Note that the research output results for 2012 has not been audited as of 6 January 2014.