



## **A national innovation system in the information and communication technology sector**

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**Abstract**

*Many innovative and successful companies exist in the information and communication technology (ICT) sector in South Africa. It is not clear why or how they exist. The research used a qualitative approach to determine characteristics of these companies. Senior managers, mostly owners or CEOs, of twenty companies were interviewed. Methods that originate from the grounded theory building technique were used to build a theoretical model of the National Innovation System in the South African ICT sector.*

## Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other university. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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AH Vlok

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Date

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I would like to thank my parents, Barry and Alet, and my brothers, Johannes, Jacobus, Cornelis, for their lifelong support. I thank my friends for their interest.

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# Contents

1	Definition of problem and purpose.....	1
2	Theory and literature review .....	4
2.1	Introduction to innovation .....	4
2.2	Innovation systems .....	4
2.3	The nature of innovation may limit change .....	5
2.4	The nature of innovation is change.....	6
2.5	The emergence of novelty.....	7
2.5.1	Technological opportunities – ICT as GPT .....	8
2.5.2	Learning and innovation.....	9
2.5.3	Human nature as a driving force of innovation .....	10
2.6	Conclusion of literature review .....	11
3	Research questions.....	12
3.1	Internal factors .....	12
3.2	External influences.....	12
3.3	Demographic characteristics .....	13
4	Methodology and design .....	14
4.1	Research method.....	14
4.2	Steps conducted to perform the interviews.....	15
4.2.1	How contact to the interviewees was obtained .....	15
4.3	Interview and data collection process.....	16
4.4	The questionnaire .....	17
4.5	Limitations of the research .....	19
4.6	Unit of analysis.....	20
5	Results.....	21
5.1	Companies that formed the sample.....	21
5.2	Demographics of the sample.....	23
5.2.1	Revenue analysis.....	23
5.2.2	Average age of the founding members.....	23
5.2.3	Qualifications of the founders .....	24
5.2.4	Founding location.....	25
5.2.5	Race and gender of the founders .....	25
5.3	Results analysis of the qualitative data.....	26
5.3.1	Reasons for starting the business .....	26
5.3.2	Choice of technology.....	31
5.3.3	Relationships with the industry .....	33

5.3.4	The innovation process .....	38
5.3.5	Product development .....	44
5.3.6	Influence of support contracts on innovation .....	46
5.3.7	Reasons for success.....	47
6	Discussion of results .....	50
6.1	Reason why companies in the ICT sector were investigated.....	50
6.2	Reasons companies in the ICT sector innovate.....	50
6.3	Common qualities that make innovation likely .....	52
6.3.2	Marketing.....	58
6.3.3	Product development .....	59
6.3.4	Reasons for success.....	61
6.3.5	Skills .....	61
6.4	Reasons for continued innovation or lock-in with a specific technology .....	62
6.5	Economic conditions that lead innovators to start companies in the ICT field	63
6.6	Common qualities of the investigated companies.....	64
6.7	The role of a relationship with the industry .....	65
6.8	Demographic similarities .....	66
6.8.1	Revenue and revenue.....	66
6.8.2	Age, qualifications and location .....	68
6.8.3	Race .....	69
7	Conclusion .....	70
7.1	The NIS model.....	70
7.2	New ventures .....	72
7.3	Innovation in the new ventures.....	73
7.4	Problem with the NIS in ICT .....	73
7.5	Proposition to support new ventures .....	75
7.6	Future research.....	76
	Reference list .....	77

## Abbreviations

BEE.....Black Economic Empowerment

CEO.....Chief Executive Officer

DUI.....Doing Using and Interacting

GPT.....General Purpose Technology

ICT.....Information and Communication Technology

IEEE.....Institute of Electrical and Electronic Engineers

NIS.....National Innovation System

R&D.....Research and Development

STI ..... Science, Technology and Innovation

SAIEE....The South African Institute of Electrical Engineers

VC.....Venture Capital

## 1 Definition of problem and purpose

The South African ICT sector experienced strong growth during the past ten years. This view is supported by the Gauteng Economic Development Agency (Roberts, 2009). Roberts states that research regarding the existence of companies in this sector is available but that the reports in public domain seem to be disjointed from an economic development perspective. Innovation is very important to these companies to be successful. But, research needs to be done to determine how these companies operate in order to be successful. What seems clear is that the companies in the ICT sector are successful. This research seeks to understand why there is success specifically in the South African ICT sector.

These companies use innovation to drive their success. One of the theories developed to describe this success in innovation is known as a National Innovation System (NIS). A National Innovation System does not have a single definition, but experts in the field have suggested various definitions. These definitions in (OECD, 1997) are stated below.

- *“...the network of institutions in the public and private sectors, whose activities and interactions initiate, import, modify and diffuse new technologies”*
- *“...the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge...and are either located within or rooted inside the borders of a nation state”*
- *“...a set of institutions whose interactions determine the innovative performance...of national firms”*



- *“...the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and composition of change generating activities) in a country.”*
- *“...that set of distinct institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer the knowledge, skills and artefacts which define new technologies.”*

ICT *per se* is not the service or product of the companies investigated. However, these companies use ICT as a General Purpose Technology in the product offering. The term “General Purpose Technologies” refers to an enabling technology that functions as a base platform for more advanced technologies or services. These companies seem to be successful and they have a high technological offering based on ICT. These companies use ICT as an enabling technology.

This research argues that there is an unusually high number of ICT companies in South Africa and this may be regarded as an economic phenomenon on its own. Economic phenomena (such as the performances of the companies under investigation) may be explained and assessed if one can disclose the nature of the phenomena (Schumpeter, 1911). The aim of the research will be to provide information about the characteristics that contribute to the success of companies that base their product on, or enhance their product offering with, ICT in South Africa.

This research may also be used in strategic management of business incubators such as the Gauteng Innovation Hub in Pretoria.

South Africa may benefit from this research because the research will provide a framework or guidelines for creating an environment for these types of companies. Lundvall, Lorenz & Arundel (2007) state that there are national factors in the European Union that still need explanation that may influence innovation performance and structures of companies. Thus, there may also be national factors in South Africa that still need explanation.

The aim will not be to uncover conclusive evidence to determine a specific course of action for business incubators in order to support companies that start in this sector. This research may however help to assist in creating an environment to support start up companies in this sector. It is expected that subsequent studies will be required to provide more detailed evidence.

The research will then attempt to describe the NIS in South Africa as it relates to the ICT sector. The interrelationships between the different stakeholders will be investigated. This research argues that innovation is systemic and a systematic approach will be used to map the field, where “the field” refers to the National Innovation System at work in the ICT sector.

## **2 Theory and literature review**

### **2.1 Introduction to innovation**

The goal of higher returns and better profits drive innovation (Rouvinen, 2002). Rouvinen (2002) refers to Schumpeter (1911) where he states that competition between entrepreneurs drives innovation.

Technology and trade productivity can almost always be improved limitlessly (Schumpeter, 1911). All possibilities are never realised in a market and if they were, there would be immediately new possibilities created (Schumpeter, 1911); (Niosi, 2002).

Factors that drive innovation and economic development are interdependent and the innovation system concept is a useful tool in understanding the influence of these factors on economic development (Johnson & Lundvall, 2001).

The companies which were considered were considered as being part of a system, known as a National Innovation System (NIS). The next section will describe what innovation systems are. The goal will be to identify the focus areas of the research by using the innovations system concept as a starting point.

### **2.2 Innovation systems**

Innovation is systemic (Niosi, 2002). There exists no single definition for national innovation systems (NISs) but all definitions have a systemic core (Niosi, 2002). The NIS concept is a systemic approach with a focus on the linkages and synergies between the different parts of the innovation system (Johnson & Lundvall, 2001). A NIS consists of two building blocks. These are

institutions and linkages (Niosi, 2002). Nioshi (1992) in Lundvall (1992) states the following: “*Institutions are a set of habits, routines, rules, norms and laws which regulate the relations between people, and shape social interaction*”. “Institutions” in this sense refer to public and private firms and universities (Niosi, 2002). “Linkages” are the flow of knowledge, people and finances between the institutions (Niosi, 2002). This report will look at innovation from a systematic view point.

The next two sections will look at the nature of innovation. The first argument is that change is limited because of innovation curtailment whereas the section thereafter will argue that change causes innovation.

### **2.3 The nature of innovation may limit change**

The argument in this section is that initial innovation by a company limits or at the very least delimits possible future innovation. The companies which were considered existed as part of an innovation system. Innovation systems are not 100% effective, and their ineffectiveness is attributed to *lock-in* and *path-dependency* (Niosi, 2002).

Niosi (2002) states that innovation systems have phenomenal characteristics which can only be explained by historical events. These events may lock companies into a specific offering and that limits innovation. Several publications mention these events and the summary of these limiting events is given by Niosi (2002) :

- Increasing returns to scale: first entrants in a market dominate the market; it will be more difficult for new entrants to enter the same market owing to higher costs because the first entrant enjoys the benefits of returns to scale.

- Dispersing standards. First entrants will disperse their standards very widely and thus exclude future competitors.
- Sunk costs: companies could get locked into their technology because of past investments in infrastructure.
- Contracts: companies could be forced by contracts to stay in a specific field and not be innovative.
- Human capital: companies invest in building human capital for example, training and modes of operation. It is expensive to change human capital systems.
- Adaptation to economic systems: some companies adapt faster than others to changing economic systems. Thus some companies get locked into an older system.

All these factors suggest considerable lock-in and stability in innovation systems due to historical events.

## **2.4 The nature of innovation is change**

The argument in this section apparently contradicts the previous argument that innovation may limit future innovation. The argument in this section is that change causes innovation whereas the previous section argued that innovation is limited because of changing conditions. In effect, of course, the two arguments may be viewed as complementary, rather than mutually exclusive.

Innovation takes place in waves Peansupap & Walker (2006). These cycles last between 40 and 50 years (Kondratieff, 1935). Peansupap & Walker (2006) refer to Sundbo (1999) and Jones & Saad (2003) who describe the first of five Kondratieff waves as the mechanisation of the industrial revolution. Sundbo (1999) in Peansupap & Walker (2006) describes the fifth wave as the ICT wave.

Each new wave occurs because of changed economic or global business environments (Peansupap & Walker, 2006). There will be many new innovations in the recovery phase of a wave or during the starting phase of a new wave (Peansupap & Walker, 2006). The ICT wave is still prevalent and thus we will continue to see more innovations in the ICT sector (Peansupap & Walker, 2006). Freeman & Louca (2001) also say that there have been five Kondratieff waves. According Freeman & Louca (2001) the first wave was the industrial revolution; the second was railroad, steam and mechanisation; the third was steel, electric power and minerals; the fourth wave was mass production, the automobile and oil and the fifth wave is ICT and biotechnology (Freeman & Louca, 2001).

## **2.5 The emergence of novelty**

The previous two sections presented complementary or even contradictory approaches. “The nature of innovation may limit change” argues that innovation inhibits change and future innovation. “The nature of innovation is change” argues that change is the cause of innovation. It seems that innovation will, therefore, be characterised by both novelty and stability.

The current Kondratieff wave is in the ICT sector (Freeman & Louca, 2001). This wave will, therefore, bring change. The theory presented in the subsequent sections investigates possible characteristics and opportunities which are important for companies to be regarded as being innovative and successful.

Companies build competence in three areas. These areas are internal competence, employee competence and network positioning (Johnson & Lundvall, 2001).

### 2.5.1 Technological Opportunities – ICT as GPT

Innovative companies do not become locked-in to a specific technology. The technology they choose must enable them to continue to innovate. Technology constantly changes and it is thus difficult to prevent being locked-in. This section argues that new technological opportunities can be exploited because the offerings of the investigated companies are based on a General Purpose Technology (GPT).

GPTs are characterised by their potential for use in a wide range of technologies because of their dynamic nature. These GPTs open up a lot of new opportunities in the economy. GPTs thus act as enabling technologies. The economic effect of this is called ‘Innovation Complementarities’. The productivity of research and development in the downstream sector increases as a result of innovation in the upstream GPT. Thus, advances in the GPT technology lead to new opportunities in downstream sectors (Bresnahan & Trajtenberg, 1995).

This report focuses on companies that use ICT as a GPT. This means that ICT in itself may not be the primary focus of the companies, but they use ICT on which to build their offerings.

A failure or success of a GPT has a far-reaching effect in the economy as many ‘Innovation Complementarities’ are dependent on a single GPT. There exist models which look at increasing returns in endogenous growth (Romer, 1986) but those models were based on a flat economy. Those models did not allow for interaction between different sectors (Bresnahan & Trajtenberg, 1995).

Lipsey, Bekar and Carlaw (1998) argue that a GPT initially has a large possibility of improvement but as it stabilises, it becomes widely used with many applications. Electricity, steam and ICT are generally regarded as the most

important examples of STI (Grain, 2004). This really means the commoditisation of a technology.

## 2.5.2 Learning and innovation

The current economy is a “knowledge based economy” (Johnson, Jensen, Lorenz & Lundvall, 2007). It is, therefore, important to understand how companies use knowledge to support innovation.

Johnson *et al.* (2007) identify two learning modes in organisations. These are Science, Technology and Innovation (STI-mode) and Doing, Using and Interacting (DUI-mode). The STI mode is regarded as the scientific mode of innovation where there is a strong reliance on research and development. Companies studied by Johnson *et al.* (2007) in the STI learning mode have strong ties with universities and they employ people with formal qualifications. These companies do not say much about the DUI learning mode.

There are four different mechanisms through which learning takes place and according to Johnson *et al.* (2007) these are the :

- Know-what and Know-why STI modes of learning which are learnt in books and formal academic environments;
- Know-how DUI mode of learning which is mostly learnt in apprenticeships and the
- Know-whom DUI mode of learning which is learnt mostly in social practice, specialised education environments and professional societies.

Johnson *et al.* (2007) state that the STI mode of learning was the dominant form of learning for large companies in the 20<sup>th</sup> century and it still is today. Much of the practice in most fields is not completely understood and arguably



professional engineers learn how things work” without completely understanding why (Nelson, 2003). This shows that the DUI-mode is crucial for innovation. DUI knowledge (know-how, know-whom) is usually gained by people “on the job” as they face problems in day to day operations (Johnson *et al.*, 2007)

Johnson *et al.* (2007) refers to Rothwell (1977) who states that successful innovation depends on communication and developing relationships between production and sales departments. The DUI mode can be advanced by specifically building environments that will enhance learning by doing (Johnson *et al.*, 2007). Companies that employ a mixed approach to learning (both DUI and STI) are much better in product innovation than companies that focus only on one of them (Johnson *et al.*, 2007).

### **2.5.3 Human nature as a driving force of innovation**

There are drivers behind the owners or the people who start businesses. Schumpeter (1911) groups people into three categories. Only a small group of people realises new possibilities in an economy because most people do not want to experiment (Schumpeter, 1911). The masses lack the courage to take risk (Schumpeter, 1911). There is a smaller group of people with more active imaginations. These people are aware of opportunities but they fail to put enough dedication and energy into a business initiative to make it economically viable (Schumpeter, 1911). The last group is the smallest group of people. They take action and they are described as being brave and confident (Schumpeter, 1911). They also ignore the impact that a failure might have on them (Schumpeter, 1911).

## 2.6 Conclusion of literature review

The literature review will be used to build a questionnaire to discover how the National Innovation System works in the ICT sector. The literature hints that the following aspects should be investigated:

- Path dependency and lock-in.
- Possible influence of the Kondratieff wave in ICT.
- The influence of the GPT.
- How companies learn.
- The influence of human nature on innovation.

### **3 Research questions**

The research will aim to answer one question:

*How does the innovation system in the South African ICT sector work?*

This research attempts to answer this question by analysing characteristics of companies in the ICT field in South Africa. The characteristics of these companies were determined by answering the questions below. The questions are grouped in three categories: internal factors, external influences and demographic characteristics.

#### **3.1 Internal factors**

The goal of the questions in this section is to determine similarities (if any) between the companies when looking at the aspects related to the technology and the use thereof. Lock-in and path dependency will also be investigated by using these questions.

- Why do companies in the ICT sector innovate?
- Do ICT companies have common qualities that make innovation likely?
- Are innovative companies locked in a specific technology or do they continue to innovate?

#### **3.2 External influences**

The questions in this section will determine the influence on the companies from the external environment. The questions in this section focus on the external linkages with the rest of the industry.

- Do economic conditions lead innovators to start companies in the ICT sector?
- What role does the relationship with the industry play?

- What qualities of the innovation system in the South African industry support innovation in the ICT sector?

### **3.3 Demographic characteristics**

The companies may have obvious demographic similarities. The questions in this section will investigate this.

- Are there common demographic characteristics between companies?
- Why are the companies in the ICT sector?

## **4 Methodology and design**

### **4.1 Research method**

This study used a qualitative approach. Some studies in this field support qualitative instead of the quantitative methods (Johnson *et al.*, 2007). Techniques from grounded theory building (Dougherty, 2002) and (Van Zyl, 2005) were used to build the argument.

The intention of this study was to collect information from different companies in the ICT sector. The information in which this study was interested was often implicit knowledge about the company. Contacting the people with this information was difficult as they were often the founders, owners or senior managers and were difficult to reach via formal channels. Thus the “snowballing sampling” technique was used. This technique is an informal approach to data collection. It is a method of locating initial respondents by probability methods and then locating further respondents via referrals from the initial respondents (Zikmund, 2003). The initial respondents were selected based on already existing relationships between the researcher and companies of interest.

A questionnaire with both open and closed ended questions was used. The open ended questions aimed to open discussions around the topic. The closed ended questions were used to determine demographics of the companies. The research was conducted in person, with the exception of two interviews which were telephonic. The aim was to ask questions without leading the respondent to specific answers. Content analysis of the responses was performed afterwards.

The same questionnaire was used for all the respondents. Some interviewees did not answer all the questions.

## 4.2 Steps conducted to perform the interviews

This section of the chapter explains how the researcher contacted the interviewees and how the data was collected.

### 4.2.1 How contact to the interviewees was obtained

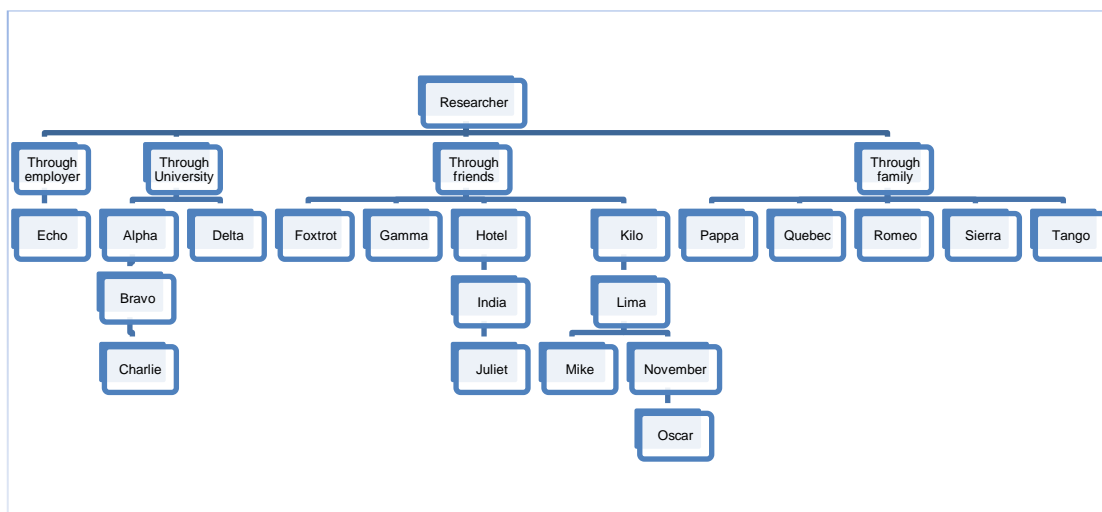
The qualification criterion for a company to be considered for this research was that the company had to have some offering based on ICT.

The researcher used four starting points to get contact with interviewees. These points were:

- References from the lecturers from the Innovation and Entrepreneurship MBA courses.
- References through friends in the ICT field.
- References through family who are active in the ICT field.
- References through the researcher's employer.

A graphic illustration of the snowball is given in Figure 1.

**Figure 1 Relationships between the researcher and the interviewees**



The researcher asked questions about the offering of a company and visited the company's website before the company was contacted. This was done to make sure that the companies qualified for the research.

### **4.3 Interview and data collection process**

The researcher phoned the person he wanted to interview. A meeting was then scheduled, usually a week later. The researcher emailed the questionnaire and the Informed Consent Letter which contained a short explanation of the research to the interviewee in advance. This gave the interviewee the opportunity to think about the questions beforehand.

The researcher visited the website of the company again and performed a more detailed review before visiting the company. This was deemed necessary to the researcher because this gave him a basic introduction to the company before meeting them.

The researcher always introduced himself and he gave a short personal background at the beginning of the interview. The researcher asked the questions and he made notes on the printed questionnaire as the discussion followed. The interviews were always structured. The questions were always asked in the order they appeared on the questionnaire.

The researcher noted specific things that were said during the interview and transcribed his notes after the interview. The interviews were not voice recorded because the researcher felt that this would create an uneasy environment and that it would thus influence the data negatively.

The researcher also asked for references to other possible interviewees at the end of the interview.

#### 4.4 The questionnaire

The questions have been asked in order to answer the global questions that appeared in Chapter 3 on page 12 which link directly back to the main research question: *How does the innovation system in the South African ICT sector work?* The questions in the right column were designed to support the main question in the corresponding section in the left column. The supporting questions were designed with the literature in mind as to shed light on specific topics of interest to this research.

Open ended questions		Supporting Questions
1	Why was the business started?	<p>Were there any political factors driving the business start up?</p> <p>What economic conditions were driving forces for starting the business?</p> <p>Were there personal reasons for starting the business?</p> <p>How did you get the opportunity or the idea?</p>
2	Why did you choose the specific technology on which to base your product or service?	<p>How did you go about considering the technology to base your product on?</p> <p>Did you consider alternative technologies?</p> <p>What is important for you when choosing a technology?</p>
3	Describe the relationships with the rest of the industry?	<p>Do you have relationships with universities, technikons or colleges?</p> <p>How do you support students?</p> <p>Do you attend industry seminars?</p> <p>Is membership of professional institutes (For example, SAIEE / IEEE) important to you? If so, then why?</p> <p>How is the relationship with the competition handled?</p> <p>How does the market know about your organisation?</p>
4	How does the innovation	How reliant are you on R&D?





	process in the company work?	<p>How do you source R&amp;D?</p> <p>How important is “learning by doing” to the company?</p> <p>How do you motivate your employees to be innovative?</p>
5	How easy would it be to develop a new product?	<p>Hypothetically speaking: the competition develops a feature and you know that your current technology cannot do it. How easy is it to adapt your product?</p> <p>Would you say that you are limited by the technology which you are using?</p> <p>How are long–running service contracts on older products influencing innovation?</p> <p>Do you influence the standards in the industry or do you have to follow them?</p> <p>Do you have investments in equipment which keep you bound to a technology?</p>
6	What are the reasons for the previous successes of the company?	<p>How did your positioning in the market influence your success?</p> <p>Are the skills that you require readily available?</p> <p>How does the culture and work ethic influence your company?</p>
<b>Demographics of the leader or the founder</b>		
7	When was the business started?	
8	What is the age, gender, ethnicity of the founder and/ or the current leader?	
9	What and where did the founder or current leader study?	
10	Where was the business started?	
11	How was the business financed?	
12	What is the size of the company? How many people are employed?	
13	What is the revenue, profit margin?	

#### **4.5 Limitations of the research**

The sample size of the research was 20. However, it became clear that there were many more companies available which would have been willing to participate in the research.

All the companies were contacted through informal connections, these connections were almost social. This means that the sample is not random and that all the interviewees will most likely have common factors because they are all in a connected social network.

Interviews were all conducted over 90 minutes, but this was often not enough to have a relaxed interview. Data, which may be interesting to this research, could have been missed because of the time pressure on the interviews.

Some interviewees were not comfortable enough to answer some questions; those questions were either avoided or not answered.

Black Economic Empowerment did come up at times during the discussion on political factors but the researcher felt that the honest opinions of the interviewees regarding BEE required a certain level of trust between him and the interviewees due to the nature of the topic and South Africa's sensitive political situation with regards to the BEE legislation. All the interviewees were white and it can thus be understood that they would be careful when answering a question about BEE. The researcher felt that he could not win the trust of the interviewees in time and thus the answers to this question were not taken into account in the research.

The researcher made notes of things that were interesting to the study, but the researcher did not write down the interview verbatim. This may limit the research as nuances could have been lost in the process.

#### **4.6 Unit of analysis**

The unit of analysis was companies that employed ICT as a General Purpose Technology in their offering.

## 5 Results

The results are discussed in this chapter.

### 5.1 Companies that formed the sample

The names of the interviewed companies may not be revealed and thus Table 1 is used to give the reader an idea of the companies in the sample.

Table 1 Sample description

Sector detail	Product	Customers	Interviewed
Telecoms (prepaid)	Prepaid recharge voucher creation and distribution	Nigerian cellular network operators	Owner
Consulting on new products	Simulation of new products	Cellular network operator in RSA; Large international vendor of network equipment	Owner
Information technology	Payroll systems	Various	Owner
Financial	Unit trust investment platform	Portfolio managers	CEO
Information technology	Project management software; Blackberry integration; Customer Relationship Management & Enterprise resource planning (ERP) systems	Various	Director
Business documentation	Creating/storing/archiving/ e-publishing)	Large bank in South Africa, Vehicle tracing company, large packaging company, and various other	Owner
Inter/intranet security	Encryption technology	RSA government	MD / shareholder
Financial	Banking core equipment	Banks (300 customers in 50 countries)	Senior vice president
Software engineering	Financial simulation; e-commerce; database design; network security	RSA government, various other	Owners
Financial	Investment software	Banks in South Africa	Owner



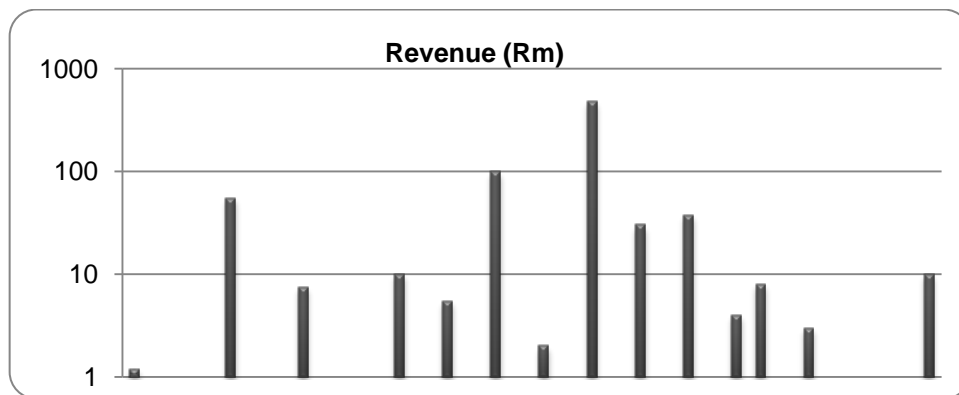
Sector detail	Product	Customers	Interviewed
Telecoms (cellular)	New product development / consultation	<i>Large cellular network operator in South Africa</i>	Owner
Security	Electronic gated community security systems	<i>Gated communities in Pretoria</i>	Founder
Marketing	Cellular telephony marketing technology	<i>Large cellular network operator in South Africa; Youtube</i>	Director
Telecom	Geographical information systems	<i>Large cellular network operator in South Africa; others in Ireland, Bangladesh, Hong Kong</i>	Senior consultant
Telecom	Consulting	<i>Large cellular network operator in South Africa; offices in Madeira and London</i>	Owner
Telecom	New product development	<i>Large cellular network operator in South Africa</i>	Owner and Head of division
Telecom / IT equipment reseller	Sales services	<i>Various</i>	Owner
Telecom / IT equipment reseller	Sales / integration / consulting service	<i>Large cellular network operator in South Africa and various other</i>	Executive director and co-owner
Financial	Transferring sensitive financial information between financial institutions	<i>Large banks in South Africa and various other</i>	Senior employee
Information technology	Enterprise resource planning (ERP); Business intelligence; Computerised management maintenance; Laboratory information management systems	Various – local and international	Managing director

## 5.2 Demographics of the sample

### 5.2.1 Revenue analysis

Companies did not give exact numbers but instead gave rough ideas of their revenues. The graph below gives only an idea of the revenue of the companies. Four companies did not disclose their profit. Two companies did not show a profit.

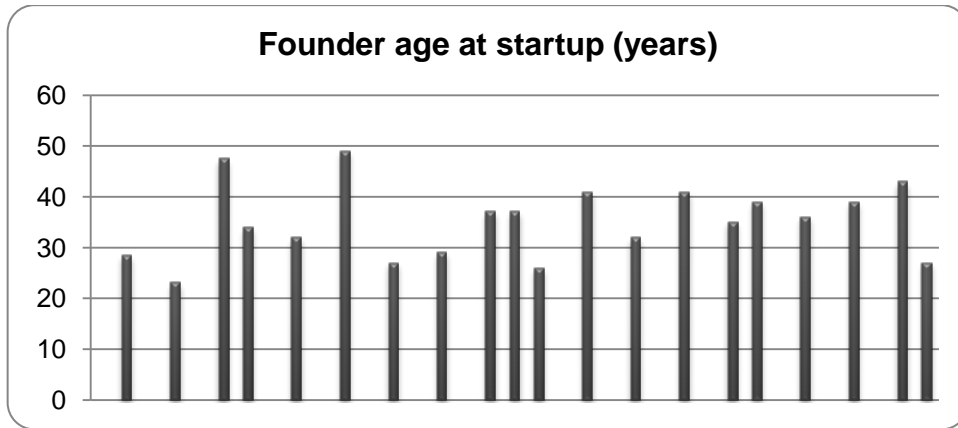
Figure 2 Revenue



### 5.2.2 Average age of the founding members

Some companies had more than one founding member. The average age of the founding members is given in Figure 3. The age given in this graph is the age of the founders at the start up of the company. The average age of the founders at the company start up is 35,5 years.

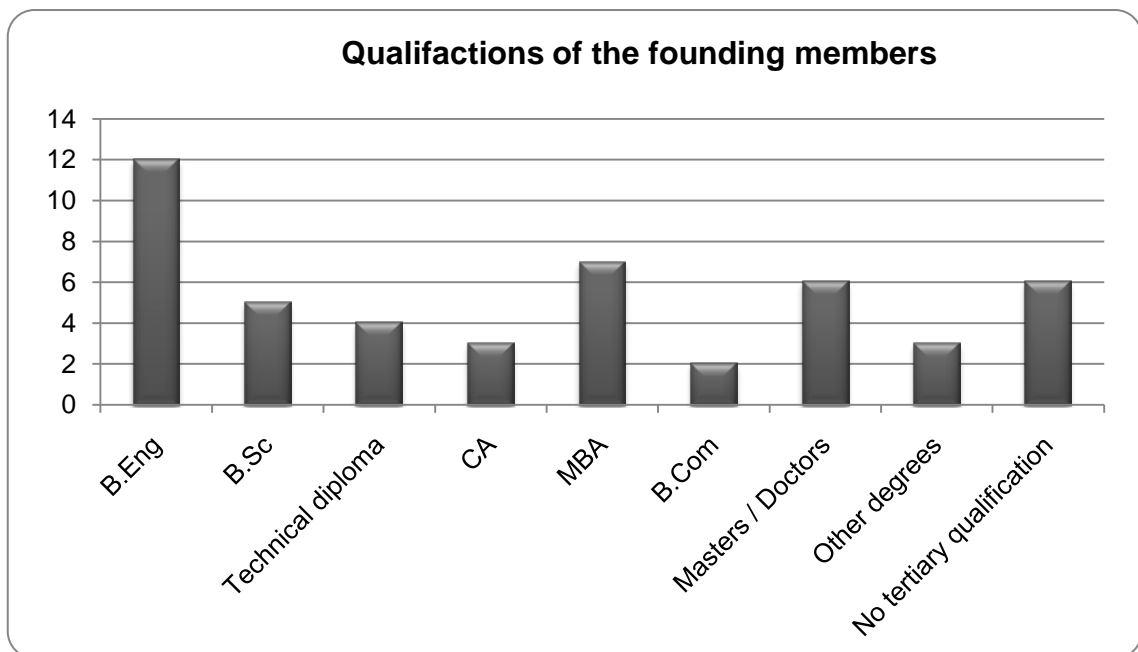
Figure 3 Average age of the founders



### 5.2.3 Qualifications of the founders

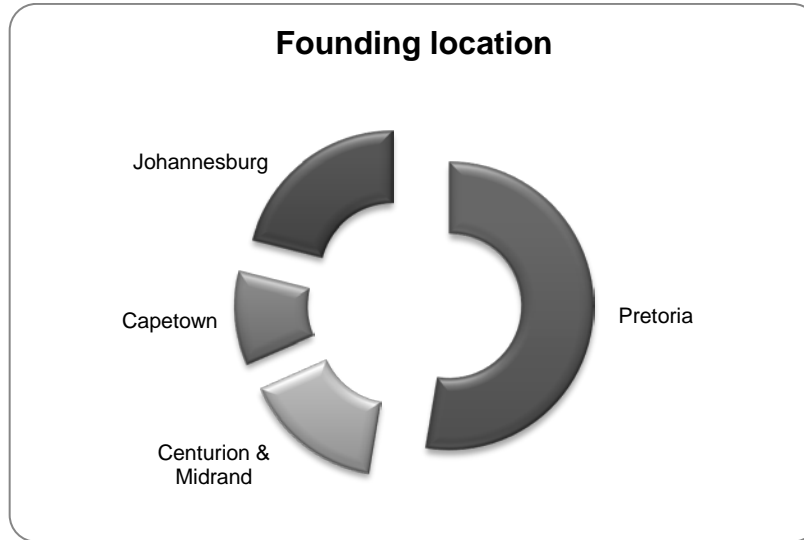
All the different qualifications of the founders are given below. At least 25 out of the 48 qualifications were obtained from the University of Pretoria, reflecting the effect of the social network. In addition, the founding location of the business also strongly reflects the effects of the social network.

Figure 4 Qualifications of founding members



## 5.2.4 Founding location

Figure 5 Proportion of companies per location



## 5.2.5 Race and gender of the founders

The interviewees represented 35 people who started the 20 businesses in the sample. All the people who started the businesses were white males except in one case in which the business starter was a white female.



### 5.3 Results analysis of the quantitative data

The results were recorded during discussions. Not all companies answered all questions.

#### 5.3.1 Reasons for starting the business

The answers to the first question: “*Why was the business started?*” have been listed below in Table 3.

Table 2 Reasons for starting the business

Factors contributing to start-up	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
Saw a gap		X	X	X	X		X		X	X			X		X		X					10
Was Involved in a previous company			X		X					X		X	X			X		X	X			8
Worked for a big corporate			X					X									X		X			4
Dislike red tape / bureaucracy			X				X											X	X			4
Independent personality – be the boss						X	X							X			X					4
Not for money																	X					1
Possibility to make more money in future						X	X	X						X								4
Started new business with a partner			X		X	X	X	X			X	X				X	X				X	10
Domain knowledge	X			X	X					X											X	4
Bored											X											1
Aware of inherent talent/skills								X			X											2
"Not sure what to do"								X			X											2
Change in legislation created gap									X													1
Expensive import created local gap									X													1
Owner is an "entrepreneur"		X		X																		2
MBA syndicate assignment	X																					1
Vision from God																				X		1
Expensive development costs abroad				X																		1

A frequency analysis was performed. A few reasons occurred more often than others. These answers were ‘saw a gap’, ‘was involved in a previous company’ and ‘the business was started with other people’. A high frequency of any

answer does not make the less frequent answers less significant as they may give important clues indications about, for example, the type of person who would start such a company.

One such important clue was the 'Change in legislation created gap'. This hints that a change in the environment creates new opportunities. Many of the answers related to the personality of the owner; an example of this is the fact that four of the people had problem with "red tape". One interviewee said "*red tape irritates the \*\*\*\* out of me, and you may quote me on that!*" This indicates individualism and independence, which may also suggest that the owners were innovative. One interviewee said specifically that the "red tape" irritated him very much.

A more detailed discussion of the supporting questions asked when establishing the reasons for starting the business follows.

#### **5.3.1.1 Were there political factors driving the business start up?**

A question about whether political factors contributed to the business start up was asked to determine if national political policies (both past and present) had an influence on starting the business. A large number of owners (15) said that politics did not drive the business start up. One company did not answer the question. The remaining four companies who said that politics did drive the start up gave the following reasons:

- the elections created an opportunity,
- Black Economic Empowerment (BEE) prevented permanent employment of white people and thus the customer used them as a company whereas they would have employed them permanently if the BEE legislation did not exist,

- government had a long term strategy and their company fulfilled a need for this strategy, and
- sanctions in the past prevented the import of technology and thus it had to be developed locally.

**Table 3 Political driving factors**

Political	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	
Political driving factor	no	yes	no	no	Yes	yes	no	no		no	yes	no	no	no	no	no	no	no	no	no	no
Reason if "yes"		Elections			BEE	Government					Sanctions										

### 5.3.1.2 Economic factors driving the business start up

Not all companies answered this question. Table 5 below gives the economic driving factors that did cause the owner to start the company.

**Table 4 Economic driving factors**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Economic driving factors</b>																						
ICT caused growth in economy			X																			1
Market conditions	X			X				X							X							4
Easy to start IT company	X																					1
Change in industry												X										1
Available savings from previous job											X											1
International company makes savings using SA company					X																	1

### 5.3.1.3 Personal reasons for starting the business

It is clear from Table 6 below that the drive to be independent was recorded for half the companies interviewed. Nine interviewees described the person starting the business as an “entrepreneur”.

**Table 5 Personal reasons**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Personal driving factors</b>																						
Wanted to be independent/dreamt of own business / wanted to have own business	X			X	X			X				X	X	X		X	X			X		10
Is a entrepreneur / passion for entrepreneurship	X		X	X			X		X	X			X		X					X		9
Tired of large corporate / dislike bureaucracy			X				X	X											X			4
Was bored											X											1
Money														X	X							2
Vision from God																				X		1

### 5.3.1.4 The opportunity for starting the business

Half of the interviewees said that they got the idea while working for another company. Only two of the interviewees said that they got the ideas because they are innovators at heart. The results are listed in Table 7



	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Source of idea</b>																						
Vision from God																					X	1
<b>Experience in the market</b>	X		X	X	X			X		X					X					X		8
Innovator at heart / always looking for new ideas																	X	X				2
Saw a gap				X					X	X							X					4
<b>Saw a gap while working / consulting another company</b>			X		X		X	X				X	X		X	X	X		X			10
Cold calling											X											1
Customer need		X				X																2
MBA assignment	X																					1

### 5.3.2 Choice of technology

This section shows the results for the questions relating to the general purpose, or enabling, technology that the companies used. Support, cost and stability of the GPT were some of the major considerations.

#### 5.3.2.1 Reason for choice of the specific technology on which the product or service is based

The answers are given below in Table 8.

Table 7 Reasons for technology choice

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Why this technology?</b>																						
Best available		x		x																		2
Trend			x	x																		2
Had experience in it					x						x	x	x	x								5
Limited alternatives						x																1
<b>Customer influence</b>							x			x	x	x		x	x	x						7
Did not think about it								x														1
Needed "Of the shelf"									x													1
Market analysis			x																			1
Used an expert's advice															x						x	2
Vendor is a friend										x												1
Historical reasons										x	x	x										3

### 5.3.2.2 Important factors considered when choosing a technology

This question was asked to determine what factors the interviewees thought were important when choosing a technology to base their offering on. It may seem that this question is not related to innovation systems; however, these answers show which qualities of a specific GPT are considered by companies. These qualities had an influence on their strategy.

Table 8 Important when choosing a technology

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count
<b>Important in technology</b>																					
Platform independence											X										1
Good tooling/ developer support											X			X						X	3
Saleability											X		X								2
Future compatible									X												1
Speed of development					X				X					X	X						4
<b>Support</b>	X			X					X	X		X		X	X			X			7
Local support		X											X		X						3
Skills availability	X								X						X						3
<b>Cost</b>	X	X				X		X	X		X				X	X	X	X	X		11
Ease of use		X																			1
Customer need			X											X	X						3
<b>Robustness / stability</b>				X				X					X	X		X	X		X	X	8
Availability								X		X											2

### 5.3.2.3 Consideration of alternative technologies

Sixteen out of the 20 interviewed companies did consider alternative technologies before making a final decision. This shows that these people made informed decisions and that there were alternative technologies available.

### 5.3.3 Relationships with the industry

#### 5.3.3.1 Relationship with the rest of the industry

Table 10 gives the answers to the question: “*Describe the relationships with the rest of the industry?*” Two of the companies said that they had had relations with tertiary institutes in the past but not anymore. Thirteen of the companies had ongoing relations with tertiary institutes. These relations differ. The different relations were:

- Friendships with lecturers.
- An employee who was busy with a PhD.
- Sourced ideas from students on the Stellenbosch campus where the popular instant messaging company MXIT’s was born.
- Supervised students employed by owner.
- Relationship with a business school (GIBS).
- Student internships.
- Sponsor university laboratories.
- Part of a university project.
- Train post graduate students.

Fifteen companies said that they supported students. The strong external linkages with tertiary institutions suggest that tertiary institutions have an important function as part of the NIS in the South African context. Most of the linkages were with a university. The links with the companies and universities did in most cases focus around students. The companies used the linkages either to build relationships for the future or for recruitment. There was no mention of links with venture capital (VC) companies or financial help via the university. These links with the tertiary institution seem to be long term



“investments” for the companies but with no immediate advantage for the companies involved.

Membership of professional institutes was seen as unimportant to 14 companies. The four companies who said it was important did so because they believed that professional membership may have some value in creating a professional impression. There was no mention that professional membership had a real influence on business.

Seven of the companies said that they attended industry seminars, while eight said that they did not. The interviewees appeared to think that seminar attendance has value. Three of the interviewees who said that they did not attend industry seminars also said that they plan to attend in future. Three companies said that while they attended international seminars, they felt that there was little value in local seminars.

It appeared as if the value of seminars was underestimated and the role of seminars played in the South African context did not add too much value. People relied on personal networks, relationships and word of mouth rather than making use of a seminar as a marketing platform. The companies who said that they did attend industry seminars did not say much more about seminars and the value thereof. One may argue that the value of seminars in the NIS in the South African context is either underestimated or unimportant.

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
Relationships with industry																						
Relationships with tertiary institutes	x	x	x		x	x		x	x		x	x	x			x		x			x	13
Attend seminars		x		x					x		x	x	x								x	7
Attend international industry seminars					x										x		x					3
Want to attend seminars	x															x				x		3
Had relations with tertiary institutions				x			x															2
Supports students		x	x	x	x	x		x	x	x	x	x		x	x	x	x	x				15
Membership of professional institutes is important.		x	x									x										3
Membership of professional institutes is not important.	x			x				x	x	x	x		x	x	x	x	x	x	x	x		14

### 5.3.3.2 Relationship with the competition

Only two companies mentioned that they compete aggressively locally. Seven companies said that they did not have local competition. The initial question was “How do you handle the relationship with competition?” The question “Do you have competition?” was added later on because the researcher received many answers that implied that the companies did not have a competition strategy and they did not feel they had competition nor were they concerned about it. One of the interviewees said “*we have competition, but we are not really concerned about them. Competition is not a strategic consideration for us*”. Some interviewees gave answers like “*mmm, let me think, I don’t really know about competition*”. Table 11 may create the impression that there was

healthy and fierce competition, however, as mentioned above, competition did not play a role in some companies' strategies. Seven companies said that they did not have local competition and four said that they were not concerned about competition. It is interesting to note that two companies said that they work with competition. Rouvinen (2002) refers to Schumpeter (1911) where he states that competition between entrepreneurs drives innovation. Thus, competition is important for a NIS, but the results in this section show that competition did not play an important role in the NIS in the South African ICT context.

**Table 10 Relationship with competition**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Competition</b>																						
Informal / discreet relationship														x								1
Friendly relationship									x													1
<b>Local competition</b>	x	x	x	x			x							x	x				x			8
No local competition						x		x		x	x						x	x		x		7
International competition					x											x				x		3
Concerned about competition	x	x	x	x									x	x					x			7
Not concerned about competition					x		x								x		x					4
Work jointly with competition													x		x							2

### 5.3.3.3 Marketing

Some of the interviewed companies were still relatively small and they relied a lot on “below the line marketing”. Two companies said that they did not do marketing; one of them said that they did not market themselves as they felt that marketing would increase their workload beyond their capacity. The same

company even said it had a rather poor website. One company said “the marketing budget is zero”. One of the interviewees said “we are bad at marketing”. One of the interviewees said that below-the-line marketing was their main marketing tool. The same interviewee said that they did “above the line marketing” like “putting up a banner up at the airport” not to win new customers but show their existing customers that they were “out there”. The term “word of mouth” was mentioned by ten interviewees during the interviews. Only four of the interviewees mentioned that they had an active sales department. One interviewee said that they market by creating industry events. These results suggest that the companies were technology driven and not market driven. This statement will appear to be contradictory to the next section.

Table 12 below shows the results regarding marketing.

**Table 11 Marketing focus**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Marketing</b>																						
Don't do marketing											x					x						2
Industry seminars												x										1
"Word of mouth"	x	x	x	x	x					x	x			x	x		x					10
Direct/targeted marketing			x		x		x		x			x					x		x	x		7
Sales department		x						x				x			x							4
Website		x		x							x	x										4
"Above the line"		x		x																		2
Internet user groups				x																		1
"Below the line"								x	x	x												3

### 5.3.4 The innovation process

#### 5.3.4.1 The companies' innovation process

The question “*How does the innovation process work in your company?*” was asked. Table 13 summarises these answers. It is interesting to see that 13 of the companies said that their ideas came from a customer need or a problem. This means that the customer need or problem sparked the innovation process. This is a bit contradictory to the previous section because the companies appeared to have done little marketing and yet they seemed to have responded very closely to their customers' needs. The relationship between the companies and the customers are an important aspect of any NIS and this will be discussed again in Chapter 6.

One of the companies said that “*Showing up is a big part of the success*”. The same company said that customers had latent needs which they did not mention because they did not know that the supplier could fulfil that need.

One of the companies said that they put the employees with the most aptitude in the innovation group. The CEO of this company referred to the employees in this group as “*the smartest guys*”. This group did not work with deadlines and it operated independently. Its work was only to innovate and it reported directly to the CEO. The CEO said that the people from the core (innovation) group were not allowed to work on customer projects except with his personal clearance. There were three companies which had specific innovation groups. Both the two largest companies had innovation groups and they had strong focus on these innovation groups. This is interesting because it seems that companies need to formalise innovation with a group when it becomes large. “Large” in this sense refers to the larger revenue and higher number of employees relative to the rest

of the sample. One of these two largest companies said “we do not want everybody in the company to innovate”.

Only one company said that it got ideas from the competition. Two companies said that they did specific literature reviews. Two of the companies said that innovation was “unstructured”.

**Table 12 Innovation process**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count
How does innovation work in your company																					
Customer need / problem	x			x	x	x	x			x	x	x	x	x	x	x	x				13
Employ innovative people / culture		x	x						x												3
Innovation is incremental							x														1
Brainstorming gives ideas							x			x	x			x						x	5
Competition gives ideas							x														1
Innovation is unstructured								x								x					2
Literature review					x					x											2
Analyst reports/ market driven												x									1
Owner is a innovator															x					x	2
Have specific innovation group									x			x		x							3

### 5.3.4.2 Research and development

Table 14 gives the answers to questions around research and development (R&D). Fifteen of the companies said that they were very reliant on R&D.

One company specifically mentioned that Microsoft released a product and they built on that. This means that they were dependent on innovation from their supplier – Microsoft.

Four companies said that they sourced R&D both internally and externally. One company specifically said that they sourced R&D from online forums. Two companies mentioned that they were followers of the “Agile” development method. Agile is not a programming language, it is a programming method and it also contains guidelines on how to manage a software design company.

Five companies said that their product was based on open source and four said that they were based on Microsoft.

The question “How do you source R&D?” was to determine the linkage with the market when looking at the NIS with regards to sourcing of R&D. Ten companies said that they sourced R&D externally; ten said that they sourced R&D internally and three companies said that they sourced R&D both internally and externally. The sourcing of R&D is important for highly technological companies and this sourcing is an important aspect of a NIS because it shows where R&D originates from.

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
Technology																						
Very reliant on R&D	x	x	x		x	x				x	x		x	x	x	x	x	x	x	x	x	15
Not too dependent on R&D				x				x														2
Source R&D internal		x		x	x					x	x	x		x			x	x			x	10
Source R&D external	x		x			x			x	x		x	x	x	x						x	10
Follow external trends		x																				1
Invest heavily in R&D					x																	1
"Agile" follower				x	x																	2
Microsoft based							x			x		x	x									4
Open source based		x		x	x						x				x							5

### 5.3.4.3 Learning in the company

The question: “How important is learning-by-doing to the company?” was asked. Table 15 shows that 15 companies argued that learning by doing is the way they learn. One interviewee said “*That is how it is done. We do not do formal training*”. One interviewee said that he used people who were already trained. Only one company said that they used formal training.

Three companies said that their employees used and contributed to online forums. The use of online forums is not new and it is not specific to South Africa. These online forums may have given the companies who used it access to global trends and techniques. The role of the internet and online social networks, such as Facebook and Twitter, may have an interesting function in an NIS.



	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
How does learning work?																						
"Learning by doing" is the way	x	x	x	x	x	x	x			x	x		x	x	x		x	x			x	15
Use formal training			x																		x	1
No money for formal training	x																					1
Online communities / chat rooms				x					x								x					3

#### 5.3.4.4 Employee motivation

The technical skills shortage (in computer programming, engineering and design) was a global problem at the time of the research. Employee motivation was interesting if considered as being important in a NIS where there is an overall lack of technical skills. These companies had to retain their highly skilled employees because they were not easily replaced

The answers to the question: “How do you motivate your employees to be innovative?” are discussed in this section. However, this question was answered in such a way that the researcher was convinced that the interviewees answered how they motivated their employees in general and not specifically to be innovative.

Eight companies used money to motivate their employees. One of them, the MD of one of the companies, said “*we motivate with money*” and “*we link salaries to performance as incentives*”. Six of the companies said they created the comfortable environments for programmers to work in. Eight of the companies said that they do not police their employees. Two interviewees said that they used discussions to motivate; this person said that “*people want to know that what they do is meaningful*”. The same company said that they gave

their employees “*totaliteit*” and that they tried to give them (the employees) “ownership”. One company said that they gave new technology to employees that would “excite” them.

The answers are in Table 16.

Table 15 Employee motivation to be innovative

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>How do you motivate?</b>																						
Owners innovate	x																					1
<b>Use money to motivate</b>		x						x	x	x				x	x					x	x	8
Use time-off to motivate		x							x													2
Create innovative environment			x				x			x		x							x		x	6
Motivational discussions/talks			x												x				x			3
Employees are self motivated				x												x						2
Use teambuilding				x	x												x					3
Work only normal hours					x																	1
Employ people who fit culture					x						x					x	x	x			x	6
Give challenging work / responsibility						x		x						x								3
Flat structure						x																1
<b>Do not police employees</b>						x			x	x	x	x				x	x	x				8
Listen to juniors							x															1
Choose innovators carefully												x										1
Praise innovations														x								1

### **5.3.5 Product development**

The answers to this section are shown in Table 17 and Table 18. This section attempts to determine path dependency and lock-in that the companies were exposed to. These results give ideas of why and how products evolve in the NIS.

#### **5.3.5.1 Product and feature innovation**

The first question in this section was: “*How easy is it to develop a new product?*” Many interviewees made a distinction between “product” and “feature”. Fourteen companies said that it was easy to develop a new feature; but seven argued that it was not easy to develop a new product. One company stated that they were not “*technically challenged*” but that new development needed “*time and money*”; six companies agreed that the lack of time and money inhibited innovation. A company stated that it was not difficult to develop a new product but it was difficult to get the idea.

#### **5.3.5.2 Influence of customers on innovation**

One of the companies said that having a large number of customers inhibited innovation because radical innovation became impossible as the user base of their product grew. The reason for this was that their product became so widely used that it was becoming impossible to make radical changes to it without affecting the customers negatively.



	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Product development</b>																						
Easy to develop new feature	x	x			x	x			x	x	x	x	x		x	x	x	x			x	14
Not easy to develop new product	x			x			x	x		x				x		x						7
Time & money inhibits innovation					x			x			x			x	x				x			6
Lack of skills inhibits innovation				x																		1
<b>Does the technology limit you?</b>																						
Limited by GPT			x	x										x			x		x	x		6
Not limited by GPT	x	x			x	x		x	x	x	x	x		x	x	x		x				13
Not enough skills in technology	x			x											x							3
<b>Support contracts</b>																						
Support contracts limit innovation	x									x					x	x	x				x	6
Support contracts does not limit innovation		x	x	x	x	x			x		x	x	x	x					x			11

### 5.3.5.3 Influence of technology on innovation

Thirteen of the companies said that the technology did not inhibit their innovation and six argued that it did. One of the companies argued that the technology did not inhibit them because they knew what Microsoft's strategy was. Microsoft was the supplier of their General Purpose Technology. One company said that the technology limited them because there were limited skills available in that technology.

### **5.3.6 Influence of support contracts on innovation**

Support contracts in this market were often a good source of income. The problem with support contracts was that customers who required support often needed the time of the developers who could have rather spent time on a new, and possibly an innovative product development. Six companies said that they experienced this problem.

A company said that they were still a growing company and that support contracts were good sources of income. It was difficult for them to keep a developer on an innovation project rather than earning revenue on a support contract.

#### **5.3.6.1 Influencing standards**

Seven companies argued that they influenced the standards in their industry, while 10 stated that they were standard followers. Some of the companies said that the reason why they were good was because they did follow the standards.

#### **5.3.6.2 Lock-in due to investment**

Sixteen of the companies stated that they did not have investments in equipment that kept them bound to a technology. Two companies argued that they invested a lot of time and money in developing their product. Those two companies argued that they had an investment in equipment that would prevent them from moving to a different technology.



	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
Influence standards																						
Influence standards			x	x	x				x		x	x						x				7
Does not influence standards	x						x	x		x			x	x	x	x	x				x	10
Investments in equipment																						
Investments in equipment inhibits innovation				x	x				x													3
Investments in equipment does not inhibit innovation	x	x	x			x	x	x		x	x	x	x	x	x	x	x	x			x	16
Investment in development time inhibits innovation				x	x																	2

### 5.3.7 Reasons for success

Table 20 gives the reasons the interviewees felt caused their success. The question was “What are the reasons for the previous successes of the company?” There is no single reason that stood out. One interviewee felt that “*culture, values and mix of people*”; he also answered “*Allow people freedom, but hold them accountable.*”



	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Reasons for success</b>																						
Market knowledge	x																					1
Hard work / commitment	x														x		x					3
Cash available	x																					1
Niche player				x						x							x					3
Reaction time		x																				1
Good proof of concept				x						x												2
Culture			x																			1
Innovative			x																			1
First entrant				x					x												x	3
Previous work					x																	1
Positioning / networking /partnerships					x						x											2
Product quality/ competitive						x	x					x										3
Customer relationships/ service						x					x				x							3
Good employees								x													x	2
Business model									x													1
Started in SA (no competition)												x										1
Exchange rate													x									1
Customisable product														x								1
Flexibility																	x					1
Visionary leadership																					x	1
Wide product portfolio																			x			1
Marketing																					x	1

### 5.3.7.1 Importance of positioning

Many interviewees did not answer this question: “How did your positioning in the market influence your success?” Four companies believed that their image in the market influenced their success. One company stated that they were regarded as a market leader. Table 21 gives the answers.

It appears from the data that most companies had their own unique reasons why they were successful. It may also be argued that they did not really know exactly what the reasons for their success were.

**Table 19 Importance of positioning**

	Alpha	Bravo	Charlie	Delta	Echo	Foxtrot	Gamma	Hotel	India	Juliet	Kilo	Lima	Mike	November	Oscar	Pappa	Quebec	Romeo	Sierra	Tango	Count	
<b>Positioning</b>																						
Correct relationships	x																					1
Leader	x																					1
Image in the market		x	x			x		x														4
Networking					x						x		x									3
Provide service (not just product)								x														1
Correct customers in beginning												x										1

### 5.3.7.2 Availability of skills

Fifteen companies said that the required skills were not readily available. One company said that skills problem were less dramatic after the 2008 recession. One interviewee said that many experts had left the country, and that those who stayed behind were absorbed by the larger companies who could pay them well. Another interviewee agreed with this by stating that many of their good employees found good opportunities abroad. Only four companies argued that skills availability was not a problem.

The problem of skills availability was something that surfaced time and again throughout the study. It is thus safe to argue that the availability of skills influenced the NIS greatly.



## **6 Discussion of results**

This chapter discusses the answers in Chapter 5 to the questions given in Chapter 4. The aim of this chapter is to build up to the theoretical model in Chapter 7.

### **6.1 Reason why companies in the ICT sector were investigated**

The current Kondratieff wave is in the ICT sector (Peansupap & Walker, 2006). In other words, the ICT sector is experiencing the most change and growth is thus affecting the economy the most. Section 5.2.1.4 examined the origin of the ideas to start the companies. The large majority of the answers indicated that the interviewees got their ideas for their own business while being active in the ICT sector. It was while they were working that they “saw the gap.” The companies for which they were working when they got their ideas were also in the ICT sector and they were often large corporates such as banks or telecommunication network operators. This result suggests that we are currently in the ICT Kondratieff wave and that we will thus expect innovation in this sector because all the investigated companies were part of this sector.

### **6.2 Reasons companies in the ICT sector innovate**

The goal of higher returns drives innovation (Rouvinen, 2002). The results from this section confirm this theory, as it was shown that people started their own business because they had the perception that the possibility existed to make more money in the future with an own business. A significant number of respondents said that they were not concerned about competition. The general feeling was that competition did not play a major role in this sector. Only one company said that their competition was a source of ideas. This result is inconsistent with the views of (Rouvinen, 2002) and (Schumpeter, 1911) in

section 2.1 where they stated that competition between entrepreneurs drives innovation. The question arises regarding the reason for conflict between the theory and the result. A possible answer may be found in the number of qualified people who left South Africa. One of the results showed that there were not enough skills. One of the companies said that good employees found good opportunities abroad and that the people who remained in South Africa were absorbed by the larger companies. This finding suggests that people who stayed in South Africa were absorbed by larger companies and this left gaps in the market. This statement agrees with the results which showed that entrepreneurs got their ideas because they “saw a gap”. Thus, innovation seems to be driven by opportunities and the possibility to make more money. Competition did not seem to be driving innovation in ICT in the South African context.

South Africa experienced increasingly intense sanctions from the international community during the 1980s because of the Apartheid legislation. An interesting fact from one of the older companies was that they argued that sanctions created an opportunity for them. Sanctions prevented importing technology and thus it had to be locally developed. This suggests that the political environment is an important element in a NIS.

The personality of the people who started these companies also played a role. Half of the interviewees said that they wanted to be independent. Another factor that also surfaced was that these people were exceptionally tired of or annoyed by bureaucracy and the paperwork around it. These grievances combined with a drive to be independent may have existed for a while in these individuals. Since there were opportunities in the market, these people could leave the large

organisations where they initially got their ideas for their business from and start their own companies. There were two outliers. One of the owners said that he started his business because he was “*bored*” and the other said that the owner had a vision from God. These were isolated cases. He who said that he was bored also said that he did not know what he was going to do when he started his company. He said that he knew that his skills were sought after and thus he just started. It was interesting to find that two people with only faith in their skills could start a business without really knowing what they were going to do. This supports the argument that there are a lot of opportunities in the market because, as discussed in the beginning of this chapter, the current Kondratieff wave is in the ICT sector.

### **6.3 Common qualities that make innovation likely**

#### **6.3.1.1 Innovation process**

The innovation process was discussed with the companies. Thirteen companies stated that their innovation process was driven by a customer need. This creates the question regarding the relationship with the customer, and the conclusion is that most companies operated very closely in line with their customer’s needs. The relationships between these companies were close both socially and in the business world. One company said that their customers had latent needs which could only be discovered by having a relationship with the customer. The owner of this company stressed the idea of “*drinking coffee with the customer.*” This was because their customers did not even know the full extent of the company’s capabilities and thus they did not ask for products that could have been developed for them. The customers played an important role in

the innovation process because they were often the source that sparked the ideas.

The companies did not really do much about marketing. The term “*word of mouth*” was often used during the marketing discussions. However, the customers played an important role because they were often the source that sparked the ideas.

Internally, the innovation process seems to have been driven by the employees and their skills. Two companies interviewed said that they employed people who were already trained and other companies said they looked for people who were self-driven and self motivated. Furthermore, the companies gave the employees a lot of freedom and one company even paid its programmers for products they developed in their free time. The innovation process, therefore, seems to be seen as an uncontrolled – almost natural process. This process seemed to work in the smaller more individual companies. However, in large companies innovation becomes more controlled. An example of this is the three companies in the sample that had groups that were responsible for innovation. Two of these three companies were also the largest two companies in the sample when measuring revenue and number of employees relative to the other companies in the sample.

#### **6.3.1.2 Research and development**

Most companies said that they were very reliant on R&D. This also supports the statement in the beginning of this chapter that the ICT sector was active because one can safely assume that innovative companies have to rely on R&D. It can be seen from the results that four companies used Microsoft as their GPT and that Microsoft was a growing force. One interviewee referred to

Steve Ballmer (CEO of Microsoft) who said that Microsoft's strategy was to make Microsoft the development environment of choice. He said that Microsoft did this by creating the so called "Dot Net" development environment. Another company agreed with this by saying that Microsoft supported developers with free research papers. While only four companies stated specifically that they were based on Microsoft, some of the other companies said that they were in the process of rewriting their product (code) in Microsoft's programming language because their customers required it. The topic of opensource software did come up, but the researcher felt that there was not as much focus on opensource as he expected there would be.

Three companies said that they had a specific group of people which was responsible for innovation. These were the larger companies. The sample was not large enough to prove this, but the researcher felt that large successful companies seem to have had people who were specifically tasked with innovation.

An interesting recurring theme was the Agile development technique. Not all companies used Agile, but it came out during the discussions that most were aware of the technique. The companies who used it were always in the same network, the owner either worked for one of the other companies who also used Agile or he was friends with them. Agile is a computer programming technique, it is not a programming language.

It was interesting to note that only three companies did not specifically answer the question about research and development, this leads one to think that the 17 other companies were busy with research and development because they all had a strategy around sourcing of R&D.

One cannot ignore the linkages with the international community. Many companies were dependant on innovation from, for example Microsoft with regards to the GPT. Opensource platforms such as Linux, which in this case was the GPT, are also heavily dependent on international development and innovation. This hints that the NIS, in the South African context, is dependent on global innovation on the GPT from the suppliers. The literature states that advances in the GPT technology lead to new opportunities in downstream sectors (Bresnahan & Trajtenberg, 1995). There is a clear correlation between the result and the theory. It seems that innovation in the GPT in South Africa is dependent on international innovation; whereas innovation in the product is internal to South Africa. Thus, the NIS depends on international linkages for innovation in the GPT.

#### **6.3.1.3 Learning and motivation**

Formal training, after a person has been employed, received almost no attention from any of the companies. All the companies in the sample had a very high technological focus and all of them employed highly qualified people.

The companies mostly agreed that “learning by doing” was how they learned. This means that they had to employ the right people. More than one company said that they employed people with the right attitude. All the companies interviewed had a very clear strategy on how they motivated their employees. It was interesting to find that many companies did in fact use money to motivate. Another idea regarding motivation that surfaced was the concept of freedom. Many companies said specifically that they did not police their employees. Other strategies supporting the freedom notion were: ‘work only normal hours’; ‘flat structure’; ‘listen to juniors’. This result makes sense as a significant

number of companies argued that there were not enough skills available as discussed in previous sections. Thus, the companies had to take care of their existing work force.

#### **6.3.1.4 Relationships with the industry**

The relationship between the companies and the tertiary and professional institutions and the competition are discussed in this section.

##### **6.3.1.4.1 Relationships with tertiary education institutions**

The relationship with tertiary institutions was an important linkage that did exist among 75% of the companies. National innovation systems consist of two building blocks which are institutions and linkages (Niosi, 2002). Linkages are the flow of knowledge, people and finances between institutions (Niosi, 2002). The universities had an important function in the NIS because they provided the companies with highly skilled labour.

Some companies mentioned that they were started by a whole honours class; other companies said that they do talent hunting at the university's computer science project displays. There was no notion about the flow of finances from a tertiary institution towards a business. One of the companies was started on the campus of a university in South Africa, but it left the campus soon afterwards. The linkages with tertiary institutions were all different, with the exception of two companies who said that their linkages were through bursaries. A large part of the companies said that they supported students.

There is not enough evidence in the data to conclusively prove this, but it appeared that the age of the owners made a difference in regards with the linkages to the universities. The younger owners had stronger linkages with the universities than the older owners.

The method of data collection called snowballing was used in this research. The researcher studied Electronic Engineering at a university in South Africa. The initial respondents were in most cases friends or lecturers from the same university. Most of the later respondents were linked to people in this social network. This may mean that companies that were not linked in this social network were probably excluded from the research.

A possible hypothesis in this regard is that companies in the ICT sector need highly qualified people because it is a very technologically advanced environment. These people are highly qualified and thus they built strong relationships through tertiary education institutions while they studied which they used to start and grow businesses in this sector.

Only one company mentioned that they did a project with a university. The rest of the companies did not receive anything other than skilled labour from the universities. The university thus functions as a supplier of skilled labour in the NIS.

#### **6.3.1.4.2 Professional institutions**

Companies said that membership of professional institutions did not have much value to them. One company had the perception that such membership could create opportunities for relationship building with the rest of the industry.

#### **6.3.1.4.3 Competition**

Companies were not too concerned about competition. Some companies said that they actually worked together with competition but in many cases the companies did not even know if they had competition. Thus, the linkages with competition were important in a cooperative sense. The linkages with



competition were not really important between the younger companies. The older companies had more fierce competition.

### **6.3.2 Marketing**

A very interesting result was the significant lack of attention that marketing received. A possible explanation for this may be that the market was so large that the companies had enough work and not enough capacity and thus they did not market.

Direct marketing and word of mouth were the main methods which the companies used to market. This shows that marketing was based on personal relationships with their customers and thus linkages in the industry. The study did not ask specifically who the customers were and how they were initially contracted. A hypothesis may be that the customers were also linked in the same social network and that could be the reason why “below the line marketing” worked in this market. Some of the larger companies did advertise and one of them even created industry events which may be seen as aggressive marketing. One of the smaller companies specifically mentioned that they did not market. They were in the process of entering in a partnership with a Canadian company and they said that the Canadian partner had a very aggressive sales force. This leads one to argue that if smaller companies do well in future, they could grow to the point where competition would be fiercer and then marketing could be more important. They would then not have gained the marketing experience over the years. This may be regarded as a major shortcoming to the companies in the NIS.

Some companies argued that their products were simply the best, not just in South Africa but throughout the world. They argued that the quality of their

products was the best, and that was the reason for their success. This was only specifically mentioned by three. However, two of those three companies were the companies with the highest revenue and they had the largest number of employees in the sample.

### **6.3.3 Product development**

Some companies argued that it was easy to develop a new feature but that it was not that easy to develop a new product. The researcher suspects that more companies would agree with this statement, if it had been a specific question. The reason for this was that a feature only required a change in the programming and most likely no hardware changes. Software is easier to change than hardware because a programmer only requires a computer and not much more physical tools. Sixteen companies argued that they did not have investments in equipment which inhibited innovation.

It was the opinion of some companies that the lack of resources (time and money) inhibited innovation. The companies did not say that the lack of skills inhibited innovation, neither did they say that the technology limited innovation. A possible argument may be that the enabling technology had the capacity to allow for more innovation. One of the interviewees said that he had completed research towards a master's degree in Electronic Engineering regarding the capacity of electronic hardware that was not being used by modern applications and that he had started his company because of this. This shows that enabling technology in the ICT sector seems to have more than enough capacity to allow for product development. The constraint was thus not the enabling technology itself. There were, however, companies that felt that the skills needed to use the

enabling technology, thus lacking skills made the enabling technology the inhibiting factor.

Some companies said that they rewrote their product in Microsoft because the Microsoft skills were more readily available. Some companies looked at the availability of skills when choosing a technology. Thus, the enabling technology was a determining factor in the innovation process. The availability of skills is thus a clear element of the NIS.

Some companies said that they were good because they were able to follow the standards, these companies designed solutions which implemented standards and it was thus important for them to follow the standards as closely as possible. Some of these companies wanted to influence the standards. The only way that they could change the standards to their benefit was if they could influence the governing body to change the standards. Only the governing bodies have authority to change standards. Thus, the companies who wanted to change these standards maintained strong relationships with the governing bodies in order to influence them. An example of this was one company who said that their relationship with VISA and MasterCard was thus important to them. VISA and MasterCard act as governing bodies in the banking environment because they set standards. The last group said that what they did was so new that there were no standards to follow. Thus, it seems that in a NIS there are three groups: those who follow the standards, those who follow the standards and try to influence it and those for whom there are no standards yet. The linkage with the standards governing bodies was important for those who tried to influence it. It is a known fact that big standard bodies make use of large vendors' expertise to create standards. An example of this is Siemens'

involvement in the creation of the GSM (Global System for Mobile Telecommunication) protocol. GSM is the most widely used mobile phone technology. It is seemingly important for companies, who want to grow internationally, to build linkages with governing bodies.

#### **6.3.4 Reasons for success**

The reasons for success were different for every company interviewed. The results were the opinions of the interviewees and there may be more reasons than the obvious answers given.

#### **6.3.5 Skills**

The skills shortage was a recurring theme during the interviews with the companies. A large proportion of the companies argued that the required skills were not available. The skills shortage and the effect thereof on innovation was a topic that surfaced repeatedly. Some companies also argued that they were not limited by the technology which they were using, but that the scarce skills in their respective technologies made the technology indeed a limiting factor.

The strategy of the companies regarding the choice of technology was often influenced by the availability of skills. Some companies adapted different technologies because they knew that the required skills were not available in some of the technologies. There was a smaller number of companies that actually rewrote their product in a different programming language and one of the factors that motivated them was the problem created by scarce skills in their technology at the time.

Tertiary institutions are the provider of skills. The global skills shortage was a common problem with regard to highly skilled workers. The NIS needs skills and it was clear that there were not enough skilled workers produced. The reason

for this is not clear but one may argue that the amount of innovation (if it can be measured) is a function of the amount of skills being produced by tertiary institutions.

#### **6.4 Reasons for continued innovation or lock-in with a specific technology**

All the companies were in the ICT sector. These companies all built their product or their offering on information and communication technologies. All these companies created software. None of them was doing hardware design or development.

In order to create software solutions or products one needs hardware and a software development environment. The hardware is usually a normal desktop computer. An example of a software development environment is Microsoft Dot Net Framework. This development environment can be used over and over again to create different products by creating software. The cost of such a development environment is usually once off. The only reason people invest in new hardware and software is that the technology evolves. This evolution does not happen that quickly. One company said that they did a technology review once every ten years.

From the previous paragraph, one can see that the enabling technology which could be limiting was the hardware or software development environment. However, there was no mention of any hardware or software development environments that were not available or too expensive. The data shows that the companies almost disregarded the price of the infrastructure. The cost of the GPT was not a barrier to entry in the NIS.

The interviewees argued that it was usually easy to adapt a product. They did not mention that the cost of the technology was a problem nor did they mention problems with the capability of the used technology.

Some companies did argue that they were locked in a specific technology, but they did not mention that it was a problem to them. Some companies felt that they could not easily change to a different technology because they had already spent a lot of time and money developing their product on a specific technology.

It is reasonable to argue that companies who are innovative have to do research and development. Many (75%) of the companies were very reliant on R&D. Some of the companies said that they put a very large amount of money into the R&D. One of the companies said that they were cash flow positive from the beginning, but that they did not show a profit yet because they invested so much in R&D. Based on this, it is safe to say that the companies were constantly being innovative in order to develop their products.

In conclusion companies were locked into their technologies. But the technology had so much capability and it was so general that it was not limiting to innovation. Furthermore, innovation was driven by heavy investment in R&D.

## **6.5 Economic conditions that lead innovators to start companies in the ICT field**

Owing, perhaps to the skills shortage, it appears that South Africans with scarce skills are paid very well if they work for one of the larger companies. Furthermore, it was often while working for these large companies that the owners of the investigated companies conceived their ideas for the new companies. The large businesses were often the first customers of the new companies. Some of these new companies were funded by the salaries earned

by the founders where they did contract work for the large businesses. This suggests that they were paid a significant amount.

Economic factors were not highly regarded by the interviewees as a driving force for starting their businesses. However, they may not have realised or understood the role economics plays. A result, which requires mentioning, is that a company referred to opportunities being created by the state of the international economy. They said that they got an opportunity because an overseas customer wanted to save money and thus that company brought its work to South Africa. This shows that a NIS in a technological sector is not isolated from the international economy.

## **6.6 Common qualities of the investigated companies**

Much can be said about the personality traits of the innovators who started the businesses. The focus of this study is not on psychological traits of innovators, however, it was interesting to note that similar answers to a question like “Why was the business started?” were given. This suggests people with common traits are driven to start innovative companies.

Half of the interviewees said that they started the business with other people. This suggests that while they are independent, they are also team players. Half the interviewees said that they saw a gap. Some said that they had domain knowledge before starting their companies and half of the interviewees “*saw the gap*” while working for another company. Many also said that they had experience in the market before starting their companies.

Half the interviewees argued that they wanted to be independent, or they “dreamt” about having their own business or they “always wanted an own

business”. The interviewed people had an entrepreneurial drive within themselves.

## **6.7 The role of a relationship with the industry**

Linkages with tertiary education systems did exist in most cases for the companies. These links mostly did not add any financial value to the company, as they focused on students. One cannot disregard the relationships and links which may have developed because of these links with the tertiary education system as they can be seen as a potential investment in skills.

Many of the companies were started with other people. These people were in many cases people who studied at the same tertiary institution. A reasonable argument flowing from this is that linkages with tertiary education institutions are also important because of the relationships that were built there.

The lack of competition was an interesting result in this study. Only a few companies were very concerned about competition. The question regarding competition in the initial interviews was “*How is the relationship with the competition handled?*” This question was later on changed to “*Do you have competition? If so, describe the relationship*”. Many of the initial interviewees did not really know too much about competition and many of them said that they did not have competition. However, the level of competition seems to increase with the age of the company. Some relationships with competition were important because the companies worked together with the competition. The companies considered were not concerned about competition and thus the relationships with competition did not play a big role.

The relationships with the customers, on the other hand, did play a big role. The overwhelming answer about innovation was that ideas originated from a



customer need. One of the interviewees said that this company spent a lot of time with its customers even in a social setting and through that it discovered needs which, in some cases, the customers had not mention before. Relationships with the customers, therefore, are very important because customers often give the need that sparked the innovation. This shows that social networks are an important factor in a NIS.

It is interesting to note that none of the companies said much about the relationship with their suppliers. One may argue that the companies and their suppliers were fairly disconnected because the supplier and the customer often did not engage in discussions. In other words, they did not have a personal relationship. The reason is most likely that the suppliers would be the suppliers of the computers and the software development environment. Those two products are “off the shelf” and may be bought at almost any computer retailer. A relationship with the suppliers was thus not really important. One of the companies specifically said that they wanted off the shelf technology.

Strong relationships with previous employers also meant that income was generated for the new companies. Previous employees indirectly funded new companies as they often employed the owner as a contractor and pad him or her enough to invest in the new business.

## **6.8 Demographic similarities**

This section will discuss the similarities between the companies in terms of demographics.

### **6.8.1 Revenue and revenue**

The revenue of the companies depended on how long they existed. Not all companies showed large profits. It was planned to ask specific figures regarding

profits, however, this question was not asked as the researcher found that the interviewees were not comfortable enough to answer it. Instead, the interviewees made more general statements about the profit such as “*we use a lot of our profits to fund development and thus we have not shown a profit yet*”. This comment ties in with the previously shown results that the companies were focussed on research and development. The revenue recorded shows that the companies did make money, and the focus on development shows that they were most likely still growing.

It was found that the younger interviewees had less easy access to cash and thus they had to be more creative to find means to fund their businesses. The older interviewees often had savings or another company which funded the new business. A young graduate with a good idea would most likely not have been able to start a company due to lack of funding. South Africa does not have a strong venture capital presence. South Africa falls short when one compares this with Silicon Valley (Reiss, 2009).

Silicon Valley is an innovation system that operates between the University of Stanford, the venture capitalists (VC), and the start-up companies in Silicon Valley. The VC's give people with good ideas access to massive amounts of start up capital (US\$10m–US\$20m) during the so-called A-round of funding (Reiss, 2009). One may argue that people with good ideas and immediate access to capital can start companies. None of the interviewees mentioned any support from VC funding. VC funding seem to be a missing element in the NIS in South Africa

### **6.8.2 Age, qualifications and location**

The average age, at start up of the companies, of the people who started the companies was about 35 years. This result ties in with the result which showed that the people had high qualifications. It is reasonable to infer that the people who started these companies had studied at least four years full time. This and with the fact that the business starters had also spent time with other companies before they started their own businesses shows that these people had roughly 10 years experience in the market before they started the companies. This is a generalisation and the ages and qualifications were not necessarily the same for all companies.

Most of the business starters in the sample obtained their qualifications from the same university. This is not strange because the researcher lived close to this university and most of his contacts were through the same university. Many of the interviewees were involved with large corporate businesses in the same city. The role of this university was clearly very important in the NIS. A question arising from this is what the roles of the universities in other parts of South Africa are; and whether there is a relation between the specialisation of a university and the specialisation of the businesses around the universities. Some of the businesses in the sample were started in another city and those businesses' starters studied at a university in that city. The specialisation of the tertiary institutions seems to play a determining role in the type of businesses which are created in the NIS.

### **6.8.3 Race**

All the founders of the businesses were to white. The aim of the study was not to investigate the role of race and why one ethnic group are represented more than the others. This could be considered in future research.

## 7 Conclusion

Using a systematic approach to analyse the NIS in South Africa was useful. It was found that the tertiary education system, large companies, and new ventures are the main role players in the NIS in ICT in South Africa.

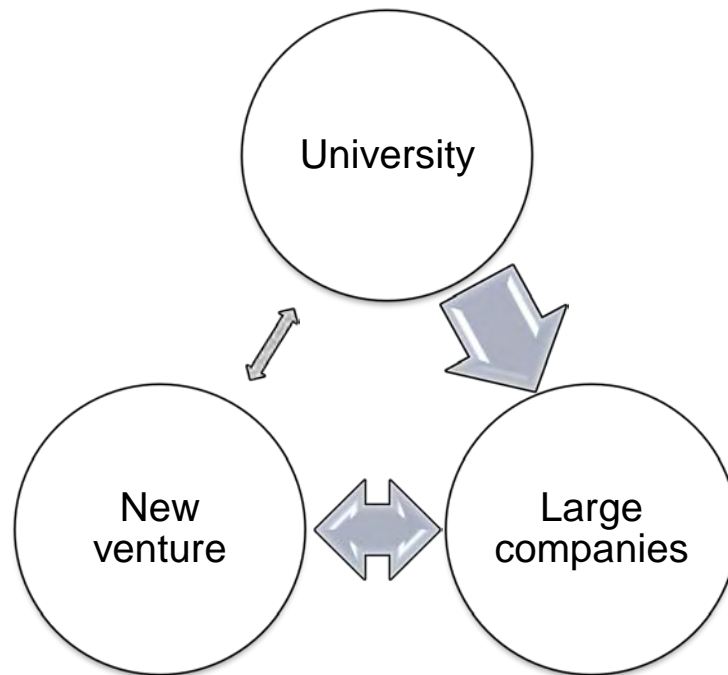
Determining a fixed model that will last, irrespective of time, is most likely not possible. One cannot ignore the fact that the economy and political factors could have major impacts on a NIS in South Africa. A NIS is an evolving system and it adapts to the environment in which it operates.

It is clear that there is no overarching dominating theme that will give a definitive model for the NIS in the South African ICT sector. Thus; this chapter will give a *theoretical* view of the NIS as it was in 2009 in South Africa in the ICT sector. The model does not explain the entire sample but it does capture the main trends.

### 7.1 The NIS model

Universities are important elements in the NIS. They are the providers of skills to the market. They seem to be an important place where like minded people meet. These people will later in their lives become involved in businesses and possibly support each other in new ventures – either as partners, customers or employees. Universities provide skills. People often find employment at a fairly large company after leaving university. Universities in this NIS are not providers of capital and companies are never introduced to venture capitalists or angel funders through universities. The specialisation of the universities could be a very important element as that could be a determining factor in the type of businesses that are later created by the alumni.

Figure 6 National Innovation System overview



Large companies play an important role because they are often the first employer of young graduates. These graduates spend a few years (less than ten) at these large companies. These companies may be large corporate companies or large governmental organisations. These are usually the places where they see the gaps in the market. It is also while working for these large companies that these future business starters build financial strength which they use later on to start their own businesses. The future business owners also build valuable knowledge of the ICT sector and they also build relationships with their employer who could later on become their first customer.

It often happens that these people resign from the company, start the own new venture, and often they remain, or return soon, as contractors to the large company who used to be their previous employer. Thus, the large company is often the first customer of the new venture. These contractors often earn more money as contractors than they would have earned if they had remained normal

permanent employees of the large company. These entrepreneurs then use part of their contracting fees to fund their new businesses. It happens also that these contractors hire developers who work for them while they (the directors of the new venture) remain as contractors at their previous employers.

## **7.2 New ventures**

These companies often have good relationships with universities. They also have good relationships with their customers and they do not spend anything on marketing. They know their market personally. The employees are often very highly qualified and thus they source new employees from respected universities. This statement contradicts the proposed model above which suggests that new employees should be finding employment at large companies. However, this is the latest trend. The NIS model is not fixed and it is already changing in this sense.

New ventures are challenged by the lack of skills. People find employment at large companies and abroad. Thus, these new ventures create very relaxed and free environments to retain their highly skilled employees. There is competition for highly skilled employees, locally and abroad. It was thus not surprising to find that employees enjoyed a lot of freedom and perks while working for any of the ICT companies.

The new ventures often have good relationships with at least one large company which, in many cases, is their main source of revenue. Most of the new ventures are still fairly young (less than ten years) with little employees (less than 20).

The new ventures in ICT need very little finance to start because they often can start with only a few personal computers and office space. However, they need

finances to be able to stop permanent employment while maintaining their lifestyle without their rather large salary.

It was not surprising that it was relatively easy to find so many companies which were active in the ICT field. The current Kondratieff wave is in the ICT sector. The nature of the GPT in ICT is such that the technology itself is so widely applicable that it does not limit innovation. The limitation of the technology is often the lack of skilled professionals. Technical ability is not the problem in this sector. Companies are mostly disconnected from the supplier of the GPT.

### **7.3 Innovation in the new ventures**

The new ventures have very good professional and social relations with their customers. Customers are often the source that sparks the innovation. The ideas for innovations originate from a customer need or problem. Innovation is mostly unstructured in the smaller companies. These new ventures rely on the innovative nature of their employees for innovations. Large companies have structured innovation and they often create a group that is responsible for innovation. The new ventures market indirectly and there is often no marketing budget. This shows that these companies exist closely to their customers.

### **7.4 Problem with the NIS in ICT**

The main problem with new companies is that they lack financial resources to grow. Often the owner has to work for a different company or take time to build up financial strength in order to start or support his new venture. This takes focus away from innovation. The biggest problem for entrepreneurs is that they do not have access to venture capital. Ideally, a venture capital society should co-exist with a university in order to support new ventures. The problem is that without a local capital input these new ventures grow to a point at which they



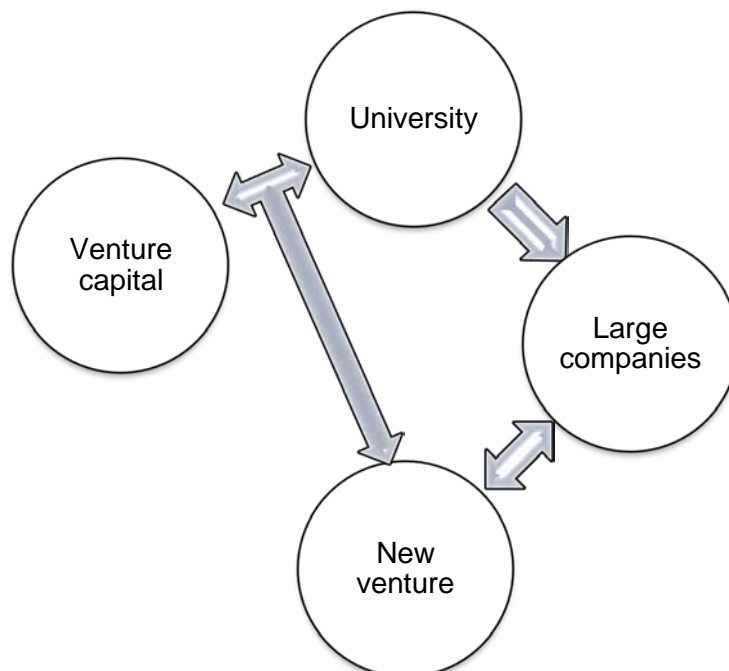
need more financial resources and then the company relocates to other countries like the USA where there is money to fund growth.

## 7.5 Proposition to support new ventures

South Africa should continue to support tertiary education systems because it is clear that innovative companies are often rooted in these institutions. Start up companies in ICT should receive financial support from government. This research has not found one instance where a venture capitalist supported the start up of a new venture. ICT is currently the prevalent Kondratieff wave and new ventures in ICT should thus be supported.

It is also clear that the role of universities is important. Thus, a proposition is to have venture capitalists partner with universities in order to support start up companies. Government should fund these venture capitalists because new companies do not show a profit quickly and that is what private investors want to see. But, it is a strategic investment in the future of South Africa.

Figure 7 Ideal NIS model



## 7.6 Future research

It seems that elements of a National Innovation Systems can be grown and in a way this growth can be controlled. Future research could focus on how to put a venture capital system in place. Future research could also focus on how to partner venture capitalists with the tertiary education system. It could be interesting to use Silicon Valley and its linkages between government, the University of Stanford and the new start up companies as a model to learn from.

Another topic of interest could be the relationship between the specialisation of the universities and the businesses which are started by its alumni. This research may benefit the government because it could possibly help the government to decide which research areas should receive support.

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