

UNIVERSITY OF KWAZULU-NATAL

TAKING IDEAS FROM MIND TO MARKET: CHALLENGES AND CRITICAL SUCCESS FACTORS FOR EFFECTIVE INCUBATION OF ICT START-UP FIRMS WITHIN THE INNOVATION HUB

By

Nonkululeko Yolette Zenobia Shinga

A dissertation submitted in partial fulfilment of the requirements for the Master of
Commerce degree in Leadership and Management Studies Programme

Leadership Centre, Faculty of Management Studies

2010

Supervisor: Prof Rob Taylor

Declaration

I, Nonkululeko Yolette Zenobia Shinga, declare that

- (i) The research reported in this dissertation, except where otherwise indicated, is my original research.
- (ii) This dissertation has not been submitted for any degree or examination at any other university.
- (iii) This dissertation does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons.
- (iv) This dissertation does not contain other persons' writing, unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then:
 - a) their words have been re-written but the general information attributed to them has been referenced:
 - b) where their exact words have been used, their writing has been placed inside quotation marks, and referenced.
- (v) This dissertation does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the dissertation/thesis and in the References sections.

Signature: _____

Dedication

This dissertation is dedicated to my dearest father, Rev Canon Simon-Peter Mkhize (1936 – 2009), who knew no limitation to his love and selflessness. I love you, Baba, for sacrificing your own happiness to protect my siblings and I. Thank you for being my spiritual guide, mentor and fortress.

Ulwile ukulwa okuhle! Halala Khize lapho usukhona ePharadisi!

Acknowledgements

As I conclude this research study, I am grateful to many people:

My supervisor, Prof Rob Taylor and the Leadership Centre staff especially Cheralyn Terblanche for their valuable suggestions, patience and support;

Dr Jill Sawers, for agreeing to participate in this study and her generosity with her time;

The Department of Science and Technology for providing the financial support;

My husband, Bazo and children Thobeka and Nqobile, for their continued encouragement and support, without which this work would not have been possible;

My grandson, Lethuzwano, for reminding me of the miracle of new life;

My brothers and sisters for believing in me;

My best friend, Dr Nomali 'Cash' Mncwabe (1959 – 2006), for instilling in me the love for learning and striving for the best – Gone too soon, but rest in peace Mntimande;

My former boss, Mr Mlungisi Thusi for guiding and developing my leadership competencies;

And I thank God Almighty, for being the rock of my refuge.

Abstract

The study examines the challenges and critical success factors for effective incubation of ICT start-up firms. Information and communication technology (ICT) start-up firms are internationally acknowledged for their contribution to economic growth, improving the quality of life and job creation.

The selected case site is the Innovation Hub which hosts a hi-tech incubator called Maxum. The Innovation Hub is an internationally accredited science park located in Tshwane, Pretoria which was launched by the Gauteng Provincial Government in year 2002.

The Innovation Hub's challenge is that its incubation programme is similar to those employed in the developed world. The off-the-shelve programme has not been customised for use within the South African socio-economic context. However, the Innovation Hub is a relatively high performing incubator which has met the prescribed precursors for success.

The critical success factors include the hands-on professional services provided to entrepreneurs, value networks and government support. In order to improve the success rate of the incubation of ICT start-up firms, there is a need to adopt a long-term approach towards innovation support and to establish an incentive funding mechanism that fosters job creation by entrepreneurs.

The objectives of the study were achieved. The researcher has extended Kumar & Kumar framework and added three critical success factors. The findings of the study cannot be generalised but can be replicated. These findings are of value to the incubator managers and also to the policy-makers when developing and enacting policies that promote incubation of ICT start-up firms.

Table of Contents

Title Page.....	i
Declaration.....	ii
Dedication.....	iii
Acknowledgements.....	iv
Abstract.....	v
List of Tables	ix
List of Figures	ix
List of Acronyms	x
Chapter 1	1
ORIENTATION TO THE STUDY AND OBJECTIVES.....	1
1.1 INTRODUCTION.....	1
1.2 PROBLEM STATEMENT	5
1.3 RESEARCH APPROACH.....	6
1.4 CHAPTER OUTLINE	7
1.5 CONCLUSION.....	8
Chapter 2	9
LITERATURE REVIEW: EVOLUTION OF INCUBATION AND THE ROLE OF INCUBATORS ON ICT START-UP FIRMS.....	9
2.1 INTRODUCTION	9
2.2 INNOVATION: TAKING AN IDEA FROM MIND TO MARKET	10
2.2.1 Different Types of Innovation.....	11
2.3 BRIDGING THE INNOVATION CHASM.....	112
2.4 THE EVOLUTION OF THE CONCEPT OF INCUBATORS.....	14
2.4.1 The USA and the European Business Incubator Landscape.....	16
2.4.2 The South African Government Business Incubator Initiatives....	200
2.5 THE DIFFERENT ORIENTATIONS OF RESEARCH STUDIES ON THE INCUBATION PHENOMENON	222
2.6 THE DIFFERENCE BETWEEN BUSINESS AND TECHNOLOGY INCUBATORS.....	233

2.6.1	Precursors to Successful Technology Incubation	255
2.7	THE SOUTH AFRICAN POLICIES FOR THE INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SECTOR	277
2.7.1	The South African Technology Balance of Payments.....	288
2.7.2	The Information Society and Development (ISAD) Plan.....	30
2.7.3	The Role of the National ICT R&D and Innovation Strategy.....	31
2.8	THE OBJECTIVES OF THE ICT INCUBATORS AS A STRATEGIC TOOL	33
2.8.1	Objectives of the ICT Incubators	34
2.9	CONCLUSION.....	35
Chapter 3	37
THE RESEARCH METHODOLOGY	37
3.1	INTRODUCTION	37
3.2	THE CHARACTERISTICS OF THE QUALITATIVE AND QUANTITATIVE APPROACHES.....	37
3.3	THE BASIS FOR THE USE OF QUALITATIVE RESEARCH.....	39
3.3.1	The Purpose of Qualitative Research.....	40
3.3.2	A Non-positivist Perspective	41
3.4	RESEARCH DESIGN	41
3.4.1	The Rationale for a Case Study Methodology	42
3.4.2	A Case for a Single-Case Research Strategy	45
3.4.3	A Descriptive Single-Case Design.....	47
3.4.4	Why the site was selected?	48
3.4.5	How the subject was reached?	48
3.4.6	Methods of Data Collection	49
3.5	THE TRANSCRIPT OF THE INTERVIEW WITH DR JILL SAWERS ...	50
3.6	CONCLUSION.....	51
Chapter 4	52
DATA ANALYSIS AND INTERPRETATION OF RESULTS	552
4.1	INTRODUCTION	552
4.2	ANALYSIS OF DATA.....	53

4.2.1	Document Analysis.....	54
4.2.2	Observations from Site Visit	56
4.2.3	What are the Challenges faced by the ICT Incubators in their Facilitative Role for an Effective Incubation of ICT Start-up Firms.....	58
4.2.4	What Are the Critical Success Factors for an Effective Incubation within ICT Start-up Firms?	67
4.2.5	How Can Incubation Success Rate be improved in the ICT Start-up Firms?	75
4.3	CONCLUSION.....	80
Chapter 5		81
RESEARCH FINDINGS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER STUDY.....		81
5.1	INTRODUCTION	81
5.2	SUMMARY OF RESEARCH FINDINGS	82
5.2.1	Challenges Faced by Maxum	83
5.2.2	Maxum's Critical Success Factors.....	84
5.2.3	Ways to Improve Maxum's Success Rate	85
5.3	LIMITATIONS OF THE STUDY	86
5.4	RECOMMENDATIONS FOR FURTHER RESEARCH.....	86
5.5	CONCLUSION.....	88
REFERENCES		90
Appendix A		104
Appendix B		106
Appendix C		107

List of Tables

Table 1: Summary of the USA and European Survey Results	17
Table 2: Divergences between the Qualitative and Quantitative Approaches.....	38
Table 3: Cumulative increase in incubated companies and jobs created.....	55

List of Figures

Figure 1: The Innovation Chasm.....	13
Figure 2: The South African Technology Balance of Payments	29
Figure 3: An Entrepreneurial Valley of Death.....	76

List of Acronyms

AIDS - Acquired Immune Deficiency Syndrome
ARC - Agricultural Research Council
CGS - Council for Geosciences
CSIR - Council for Scientific and Industrial Research
DST - Department of Science and Technology
HIV - Human Immune Deficiency Virus
HSRC - Human Sciences Research Council
ICT - Information and Communication Technology
IDC - Industrial Development Corporation
ISAD - Information Society and Development
IT - Information Technology
NBIA - National Business Incubator Association
NECSA - South African Nuclear Energy Council
NGOs - Non-governmental Organisations
NRF - National Research Foundation
OECD - Organisation for Economic Cooperation and Development
R&D - Research and Experimental Development
SABS – South African Bureau of Standards
SEDA - Small Enterprise Development Agency
SMMEs - Small, Medium and Micro Enterprises
SPII - Support Programme for Industrial Innovation
TBP - Technology Balance of Payments
THRIP - Technology and Human Resources for Industry Programme
UNISA - University of South Africa
UP - University of Pretoria
USA - United States of America

Chapter 1

ORIENTATION TO THE STUDY AND OBJECTIVES

1.1 INTRODUCTION

The contribution of new technology-intensive firms to innovation and economic growth is widely acknowledged by all countries - developed, under-developed and developing. These new technology-intensive firms are significant to regional economic development through job creation; eradication of poverty; and expansion of regional tax base. Another significant contribution of new technology-intensive firms is that they act as a catalyst to creation of new products and services resulting to the modernisation and technology-upgrading of nations.

The emergence of technology-intensive firms has attracted the attention of policy-makers. Government policy-makers and private investors have realised that innovative companies cannot succeed on their own; they require cooperation among numerous players. It has been observed that many start-up firms fail prematurely, usually surviving for only three years after their establishment. Start-up firms' failures are attributed to many reasons such as market barriers that prevent new firms to have access to venture capital; and access to complimentary resources such as staff recruitment, legal advice, marketing and advertising information.

Policy makers have considered technology incubators as the most effective economic development tool to overcome these barriers and increase the survival rate of technology-intensive start-up firms (OECD, 1999). Incubators thus offer start-up firms the promise of higher survival rate at reduced costs and duration. For the government, the establishment of an incubator demonstrates its

commitment to spurring technology transfer and commercialisation; job creation and regional or local development.

Technology incubators may be attached to a university or a research council or a science park or an industrial park to promote consultations and networks among the start-up firms, academic or research staff and other established technology-intensive businesses. This enables incubators to link start-up firms with stakeholders that offer infrastructure and a range of professional services to ensure that these new businesses are protected against possible failure (Hackett and Dilts, 2004). Technology incubators thus act as a bridge between the start-up firms and resources they require to develop and become financially independent and self-sustaining ventures.

In developed countries, technology incubators have become integral to the development of start-up firms (Albert and Gaynor, 2001; Phan et al, 2005). In developing countries, including South Africa, the use of this strategic tool in nurturing small, medium and micro sized enterprises is imperative. In all countries, these enterprises are responsible for creating most new jobs therefore incubators are essential in ensuring that this vibrant entrepreneurial sector continues to grow.

The concept of incubation, though still in its infancy, has been known in South Africa since the late 1990s and today government boasts 35 technology business incubators which have been created to accelerate technology transfer and product development. The government's vision in this regard was to decentralise job creation to the then technikons and small, medium and micro enterprises (SMMEs).

South African incubators were established with an objective of stimulating economic growth in both low and high technology sectors. Low technology sectors include essential oils processing, small-scale farming, biodiesel fuels manufacturing, stainless steel manufacturing, floriculture and nutraceuticals,

designing and manufacturing of jewelry whereas hi-tech sectors include information and communication technologies, chemistry and chemical engineering, automotives, reinforced and molded plastics, agri-foods processing, materials and processing, and metal casting technologies (DST website, 2007). These incubators focused on supporting SMMEs in a particular industry sector and promoting entrepreneurship among black South Africans (DST website, 2007). Today, these government sponsored incubators are located in the universities of technology and in industrial centres throughout the country.

For the purpose of this study, the focus will be on the incubation of information and communication technology (ICT) start-up firms as ICT is one of the major technology developments taking place globally and within the country. ICT start-up firms are internationally acknowledged for their contribution to economic growth, improving the quality of life and job creation (Yarney, 2005; ICT Strategy 2007).

The ICT sector is developing rapidly and has received political obligation from all government spheres. The ICT incubators therefore play a critical role in enabling people to move from having good ideas to having fully developed business plans on product development and to accelerate business growth. The objective is to build the strength and competitiveness of South Africa's ICT industry by increasing the rate of formation of new SMMEs.

The important question is 'Why do start-up firms or SMMEs incubate?' The response is simple. Incubators have a potential to accelerate SMMEs' growth and improve their survival rate by assisting them to become financially independent during the early stages of their business lives. Incubators also provide services such as financial advice and aid, marketing, business counseling, networking opportunities and low-rental office space. These services put incubated SMMEs at an advantage over non-incubated entrepreneurs.

Many countries have established different kinds of incubators because they have confidence in the ability of incubators to support start-up firms and to ensure that these firms survive the volatile markets (Albert & Gaynor, 2001; Lalkaka, 2003). Hence, both the practical and theoretical importance of creating incubators to maintain the competitiveness of start-up firms in complex and unpredictable market conditions has been placed high on the agendas of researchers.

There is therefore a significant amount of literature on the effectiveness and performance of incubators. The evolving literature on the incubation-incubator phenomenon is riddled with outright inconsistencies, contradicting definitions and inconclusive findings. Some studies say incubation programmes are successful, others refute that view. Nonetheless, there are researchers who agree on a few issues such as the fact that incubators differ across economic sectors; objectives; and governance and management styles (Kumar and Kumar, 1997; Kotelnikov, 2003; Veasley, 2003). Veasley (2003) goes further to say that more work is required to refine and modify theories of incubation frameworks and policies.

Whereas literature on the effectiveness and performance of incubation programmes is in abundance, very few studies have examined the critical success factors for ICT incubation programmes and these factors are still worthy of research. The current study is especially important in South Africa where the incubation concept is relatively new and has not been sufficiently explored.

For this study, the Organisation for Economic Cooperation and Development (OECD) definition which combines Sherman & Chappell (1998) and Tornatzky's (1996) definitions is adopted:

“A technology business incubator gives the entrepreneur the place and time to develop the product, as well as access to skills and tools needed to create a successful business. It fosters the growth of firms involved in

emerging technologies and has a primary objective of commercialising technology” OECD (1999).

1.2 PROBLEM STATEMENT

Mian's study (1997) found that since the implementation of the first incubation model in 1959, many start-up firms have been established and only a few succeed with the largest failure rate attributed to ICT start-ups. Mian's finding implies that there is a need to continue investigating the problems that hinder success, particularly that of ICT firms. Mian (1997) and Yarney (2005) both agree that there is very little information on the challenges and success factors of these incubators and how they impact on the survival rate of the ICT start-up firms.

1.2.1 Research Questions

- (i) What are the challenges faced by the ICT incubators in their facilitative role for an effective incubation of ICT start-up firms?
- (ii) What are the critical success factors for an effective incubation within ICT start-up firms?
- (iii) How can incubation success rate be improved in the ICT start-up firms?

1.2.2 Objectives of the Study

The objectives of the study are:

- (i) To establish challenges experienced by the incubators and incubatees in the incubation of ICT start-up firms.
- (ii) To explore the critical success factors for an effective incubation of ICT start-up firms.

1.3 RESEARCH APPROACH

The researcher has employed a single case study in a qualitative research design. The case study in question concerns an incubator located within the science park called Innovation Hub in Pretoria, Gauteng. In 2002, the Gauteng Provincial Government launched the Innovation Hub's high-tech incubator, Maxum, to improve the competitiveness and innovation capacity of start-up firms in selected cutting-edge technology sectors such as ICT, bio-sciences, electronics, advanced manufacturing and materials.

The Innovation Hub is sited on a "knowledge axis" between the Council for Scientific and Industrial Research and the University of Pretoria (Innovation Hub website, 2007). The selected case incubator is at an emergent and promising stage and does not focus on ICT incubation only and this alone could be seen as a limitation.

The selection of a case study methodology is motivated by the fact that it is commonly used in investigating a socio-economic intervention (Yin, 1989) such as the incubation programme. The objective of this approach is not just to determine the challenges and critical success factors of the ICT incubators in a specific case but also to extend it into a richer framework and produce a rich description of the incubator-incubation phenomenon being studied.

Yin (1989) argues that single case studies though their findings cannot be used for generalisability purposes but they are able to bring forth the dynamics and richness of studied phenomena. The researcher of this study selected this approach fully aware of its limitations. Hamel et al (1993) support this kind of strategy and see a single-case study as enabling the researcher to get a holistic perspective of a phenomenon under investigation.

1.4 CHAPTER OUTLINE

This section outlines briefly the content of subsequent chapters. Kumar (1995) indicates that related themes of a study should be grouped together to form one chapter. Hence, this study is organised as follows:

Chapter 1: Orientation to the Study and Objectives

This chapter introduces the reader to the study, sets out the context and rationale for the research topic; highlighting the research problem, objectives of the study and provides the research methodology employed. It also briefly outlines the following chapters.

Chapter 2: Evolution of Incubation and the Role of Incubators on ICT Start-up Firms

The literature review on the incubation evolution process and issues related to the incubation of ICT start-up firms are covered in this chapter. The different types of innovation are also identified here.

Chapter 3: The Research Methodology

This chapter describes in detail the research design, methods of data collection, methods and procedures followed in conducting the study.

Chapter 4: Data Analysis and Interpretation of Results

The chapter involves analysis of transcripts of the interviews and interpretation of results. The goal of this analysis will be to develop meaningful categories to code the data and identify theoretical constructs and patterns that will emerge from the categories.

Chapter 5: Research Findings, Limitations and Recommendations for Further Study

The research findings are presented in this chapter. The chapter concludes with the limitations to the study, and possible future research directions.

1.5 CONCLUSION

Most governments have set up incubators as an integrated endeavor for nurturing new and young entrepreneurs. The SMMEs create more jobs which lead to increased tax incomes and economic growth. The incubation-incubator phenomenon is quite complex and multifaceted and in this study it is investigated from a very narrow empirical scope. The scope of the study is limited to the incubation of ICT start-up firms. Though the study considers other theoretical views, the conclusions are still drawn from the perspective of ICT start-up firms' incubation.

The purpose of this chapter was mainly to orientate the reader to the study. The chapter included the problem statement, research questions, and objectives of the study. It also outlined the chapters into which the study is divided. The following chapter is dedicated to the literature review conducted. The literature focused on the evolution of the incubation-incubator model and on understanding the effectiveness of incubators on ICT start-up firms.

Chapter 2

LITERATURE REVIEW: EVOLUTION OF INCUBATION AND THE ROLE OF INCUBATORS ON ICT START-UP FIRMS

2.1 INTRODUCTION

The incubation-incubator phenomenon has been known since the advent of the first incubator in 1959. Incubators play an integral part in the development of start-up firms by creating an enabling environment for start-up firms to transform innovations into success. The start-up firms, in turn, are known to innovatively penetrate new markets, create new jobs and enhance economic growth.

Christensen (1997) estimated that approximately one idea out of 3000 is commercially successful in the market. Christensen also pointed out that only one out of ten non-incubated start-up firms will survive the first three years in business. Many researchers therefore agree that there is a great demand for incubators to ensure that entrepreneurs successfully take their ideas from mind to market (Campbell and Allen, 1987; Bearse, 1993; Colombo and Delmastro, 2002; Chan and Lau, 2005).

The first part of the chapter focuses on defining innovation, identifying the different types of innovation, and understanding the evolution of the incubation concept and how it is used as a bridge to innovation chasm.

Secondly, the researcher describes the evolution of the incubators in America and Europe as the pioneers of the incubation concept. This is followed by a brief description of the incubator landscape in South Africa. The differences between

the business incubators and technology incubators are explained providing an overview of this incubation-incubator phenomenon.

Lastly, focus is also drawn on the major South African policies on Information and Communication Technology (ICT); the role incubators play in developing ICT start-up firms and the objectives and functions of the ICT incubators are outlined.

2.2 INNOVATION: TAKING AN IDEA FROM MIND TO MARKET

The concept of innovation has been in use for a long time though it has a new meaning today (Pianti, 2003). Pianti further explains that fifty years ago innovation was closer to creativity and in some instances the two words were even used synonymously. Today, the focus is on how to exploit that creativity commercially and socially, that is, how creativity generates wealth and improves the quality of people's lives. As a result less value is placed on an idea, for the sake of discovery and creation, and there is more value on the exploitation of what comes from an idea to benefit people and nations.

According to the White Paper on Science and Technology of 1996, innovation is defined as *"the application, in practice, of creative new ideas which in many cases involves the introduction of inventions into the market place"*. Innovation begins with an idea which is nurtured and actually "brought to market". Ahuja & Katila (2001) noted that for successive generations, innovation has generated new ideas and industries; created new jobs; developed new modes of communication; improved national security and improved medical care.

Innovation is a composite of two worlds, that is, the technical world and the business world. When change occurs only at the level of technology, it is regarded as an invention. When change extends into the business world, it becomes innovation. Therefore, there are four aspects that define the scope of

the innovation arena namely: technology, applications, market segments or customer groups, and organisation.

2.2.1 Different Types of Innovation

Several scholars (Christensen, 1997; Ahuja & Katila, 2001; Chesbrough, 2003 and; Silverstein et al, 2005) have identified a variety of types of innovation, including for example (i) marketing innovation; (ii) organisational innovation; (iii) process innovation; and (iv) technological innovation. Organisational innovation leads to organisational change which leads to job losses. As a result organisational innovation is thought to decrease employment at firm level (Ahuja & Katila, 2001). Pianti (2003) agrees with Ahuja & Katila (2001) that process and technological innovations are the most preferred innovations by different firms and countries because they result in new job opportunities and wealth creation.

These different kinds of innovation are further grouped into two main categories, namely incremental innovation and radical innovation (Christensen, 1997; Chesbrough, 2003). Incremental innovation involves the adaptation of an existing idea to a new environment. It explores known technologies, focusing on reducing costs of processes and production thus improving competitiveness of products in the markets.

Radical innovation involves the generation of new knowledge or ideas which usually brings radical change into the markets. This knowledge or idea may be completely new to the market or country yielding high-tech spin-offs which are of significant economic value. Radical innovation exploits new technologies which either transform existing markets or create new industries.

2.2.1.1 Technological Innovations

For the purpose of this study, attention is drawn to one particular kind of innovation called technological innovation. Technological innovation is usually

described as the introduction of new processes and products in the marketplace resulting in economic gain (OECD, 1996; Schumpeter, 1934). Technological innovations are also known to result in inadvertent consequences.

Davila et al (2006) believe that on a macro level, technological innovation may result in high unemployment rate because new technologies might replace people, that is, one new machine could do a job that is done by ten people. On the other hand, Pianti (2003) argues that employment is created since the new machines have to be made by people in other parts of the economy.

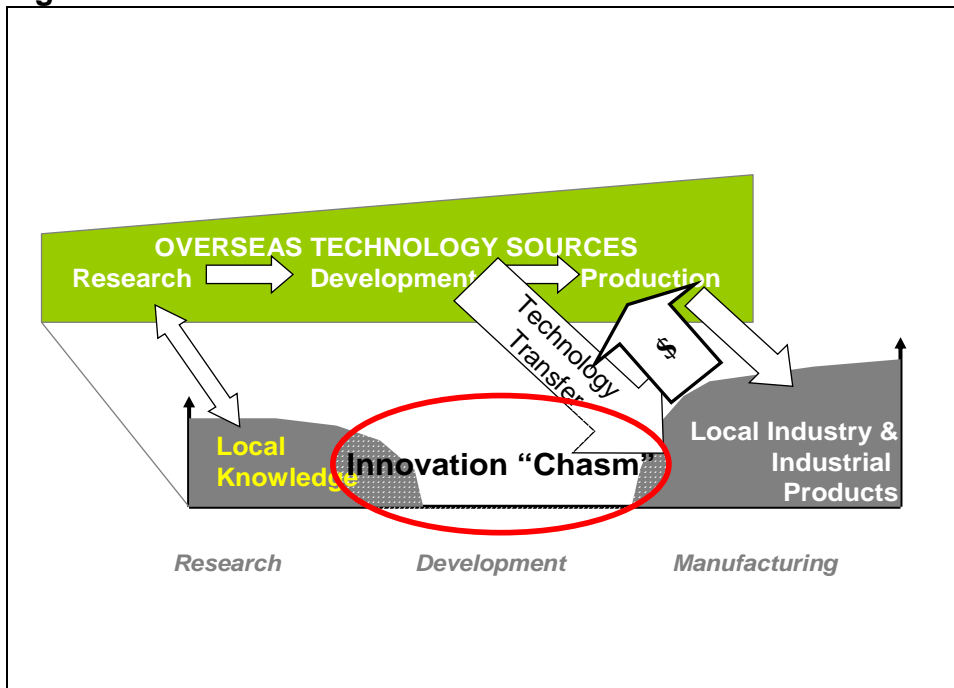
Whether this type of technology creates jobs or not is an issue for another study. However, there is consensus among the researchers (Freeman, 1982; Ahuja & Katila, 2001; Chesbrough, 2003 and; Oerlemans et al, 2003), including Pianti and Davila et al, that technological innovation is the driving force behind the competitiveness of firms and nations; and is essential to economic growth and prosperity.

2.3 BRIDGING THE INNOVATION CHASM

Many commercialisation opportunities are lost to most countries' economies for a variety of reasons but most specifically as a result of a structural innovation chasm that is evident within the National Systems of Innovation (National R&D Strategy, 2002; DST 10-year Innovation Plan, 2007). South Africa is no different. As a nation we have increased buying power which we are increasingly using to purchase products that have been developed and manufactured off-shore. This reinforces a vicious cycle that inhibits the mining of our own growing knowledge base to locally produce technology products and services for South African and international markets. This creates a gap between the reservoir of local knowledge and the industry base. This gap is called the innovation chasm.

This chasm, as depicted in the following diagram, is basically a gap between fundamental scientific basic and applied research which manifests primarily as a result of the country's inability to transform basic research knowledge into industrial products and services that are tradable in the market.

Figure 1: The Innovation Chasm



Source: Adapted from the National R&D Strategy 2002

The chasm argument is that the country's science base produces useful knowledge which we are unable to transfer to the local industry and benefit the country. The chasm depicts that there are no bridging mechanisms that link local industry to the science base. As a result, the local knowledge is transferred to industrialised countries abroad where it is developed and then exported back into South Africa. When this happens the industrialised countries remain with our country's knowledge and technology.

The innovation chasm occurs for the following reasons: (i) the country's research and development (R&D) is not linked to markets or product development process because our researchers lack the knowledge of market needs; (ii) the country's

entrepreneurs lack skills and competencies in commercialising R&D findings; and (iii) the country's entrepreneurs do not have access to venture capital for high financial risk technological development commercialisation (National R&D Strategy, 2002; DST 10-year Innovation Plan, 2007).

The innovation chasm existence is not unique to South Africa. Many countries have experienced it; because they too, lack knowledge entrepreneurs and also lack technology entrepreneurs. It is for these reasons that most countries, including South Africa, invested into the establishment of incubators to bridge the innovation chasm and also support businesses in the early start-up phase (National Business Incubator Association [NBIA], 2003; DST Ten-Year Innovation Plan, 2007). This start-up support is provided when firms' revenue streams are not attractive enough to secure loans or venture funding and thus are most vulnerable.

Incubators have since been growing in numbers because they have become the most valuable strategic tool for economic development (Kumar & Kumar, 1997; Sherman, 1998). Incubators are therefore known for stimulating wealth creation by supporting SMMEs with targeted services, support and technical assistance and they also make it possible for SMMEs to pursue new knowledge, enhance technological innovation and improve their competitiveness (Sherman, 1998).

The incubation process therefore becomes an interaction between the knowledge entrepreneurs, technology entrepreneurs, policy- and decision-makers, business sector and venture investors to develop a financially sustainable business out of technology-based creative ideas.

2.4 THE EVOLUTION OF THE CONCEPT OF INCUBATORS

Literature suggests that the concept of business incubation has been in existence since 1959 when the first incubator was established by the then

Batavia City Mayor, Mr Charles Mancuso in New York- United States of America. During this period New York had suffered a significant decline in the economy with many manufacturing plants closing and migrating to the West and the South.

The industrial closures and rise in unemployment motivated Mancuso to refurbish one vacant building which was used to incubate chickens and turned it into a place for new entrepreneurs to grow their businesses. And this is where the term 'incubator' emanated from – with a new meaning and in a new context. Mancuso rented out space to SMMEs; nurtured and guided them through their development process. Hence the Batavia Industrial Centre became the first ever business incubator.

The origins of the incubation concept are therefore traced back to the United States of America and the European community gained footing in the incubation concept thirteen years later. The first European incubator was established in 1972 in the United Kingdom. The concept spread rapidly throughout Europe bringing in a growing trend of research and theory on the topic.

Initially, both the USA and Europe used incubators to address the industrialisation crisis in affected regions or cities. The crisis had resulted in high unemployment and collapse of manufacturing industries. The USA and the European incubators were therefore primarily established for the following objectives: (i) job creation and increasing employment; (ii) to empower economically deprived communities; and (iii) to support and nurture start-up firms.

Later, incubators were used as economic development strategies for supporting and promoting emerging technology-based industries thus small, medium and micro enterprises (SMMEs) were considered as an effective tool for wealth and job creation. Today, incubators are mostly used to promote the

commercialisation of new technologies; and to serve as an investment instrument.

The evolution of the concept of incubators is summarised in the survey conducted by Lalkaka (2003) in which he categorised the evolution into three generations. In the 1980s, the “*first generation*” of incubators is characterised by providing shared and affordable physical facilities to qualifying start-up firms. The “*second generation*” of the 1990s supplemented the physical space and general office equipment with business skills, professional services, networking services and venture capital funding. The “*third generation*” of incubation model evolved between 1998 and 1999 in parallel to the second generation. This generation focused on creating hi-tech based entrepreneurs and the mobilisation of the ICT sector.

The incubator concept has been dynamically evolving since the 1980s with different forms of incubators mushrooming all over the world. The number of incubators has grown swiftly from only 12 in the 1980s to more than 3 500 worldwide with the highest number of incubators operating in America (European Commission, 2002; NBIA, 2003). Of the total number of existing incubators, 33% are located in North America, 7% in South America, 35% in Europe, 20% in Asia, and other regions constitute 5% (European Commission, 2002).

The NBIA report (2003) indicates that many more incubators will be established worldwide as more communities and countries embrace the incubation concept and realise the value of this strategic development tool.

2.4.1 The USA and the European Business Incubator Landscape

The USA and Europe are experienced in the incubation development and are the exemplars of the globe. Even though the concept has been in existence in

Europe for decades, most of the European incubators were only created between 1990 and 2000. Therefore, the European incubators are relatively young compared to their USA counterparts.

The 1991 United States National Business Incubator Association (NBIA) survey and 1994 European incubators' survey provide similarities and differences between trans-continental incubator models in the early 1990s. From these empirical surveys, it is evident that to benchmark incubator best practices trans-Atlantic would be a challenge because the USA and Europe have different types of incubator models, that is, the USA incubator landscape is dominated by the university-based technology business incubators and Europe mostly consists of industrial-based business and innovation centres. The surveys' results are summarised as follows:

Table 1: Summary of the USA and European Survey Results

	United States of America <i>(based on 150 incubators)</i>	Europe <i>(based on 107 incubators)</i>
Strategic objective	Job creation and real estate appreciation	Job creation and fostering of new start-up firms
Incubator model	Technology business incubators mostly hosted by universities	Mostly Business and Innovation Centres
Incubator size	1 764 square metres supports 12-20 tenants	3 500 square metres supports 20-30 tenants
Services offered	Office space & equipment, marketing & financial advice, legal advice, managerial training, seed funding	Office space & equipment, seed funding
Occupancy rate	60%	44%

Age	60% more than 7 years old	33% more than 5 years old
Financial Support	More than 50% supported by government and universities	Mostly private funded <i>(figure unknown)</i>
Number of jobs created by government supported incubators	7 250 at an average cost of US\$1 100	6 000 at an average cost of US\$800
Total revenues generated by tenants and graduates	US\$148 million	US\$200 million

Source: Adapted from the European Commission studies (2002, 2005)

The last few decades have seen a rapid increase in the number of new incubators both in the USA and Europe. Recent studies commissioned by the European Commission in 2002 and in 2005 to review and analyse the incubation concept revealed that the USA and the European incubator industries are well established and successful with respect to nurturing start-up firms' growth, speeding up economic development, and increasing job opportunities.

The European Commission studies (2002, 2005) further indicate that Europe lags behind the USA in terms of innovation hence there is a compelling need for Europe to re-evaluate its policies and put systems in place that support research-led innovation and encourage the establishment of innovative industries.

The concept of providing professional services to emerging companies did not take hold in Europe until late 1990s but today, incubator tenants are exposed to a wide range of professional and business services such as legal advice, marketing, networking, accounting service.

There are now around 900 incubators spread across 25 European Union member states (European Commission, 2005). An average European incubator

can accommodate up to 220 tenants which is a significant increase from 30 tenants in the 1990s (European Commission, 2005).

Most of the incubators in Europe receive financial support from both national and regional governments. Almost 48% of incubators are publicly funded and the European Union alone has sponsored about 33% of the incubators (European Commission, 2005). This is a shift from the 1990s during which most European incubators were privately funded.

Knopp's (2006) survey of American incubators found that there are approximately 1 115 incubators in the USA, of which 21% are sponsored by government; 20% by the universities and 8% sponsored by both government and private companies. There is not much change in the USA incubator landscape since the NBIA survey of 1991 except that there is now a new model of internet incubators. While the worldwide total number of these incubators is unknown, the USA hosts more than 40 internet incubators (Hackett and Dilts, 2004). The internet incubators support a different breed of start-up firms from the traditional incubators and they provide different services such as direct finance and selling shares to their start-up firms and graduate networking services.

There is a general view amongst international researchers (Albert & Gaynor, 2001; Brusoni et al, 2001; Hackett & Dilts, 2004; Phan et al, 2005) that the USA incubators produce better results than those of their European counterparts even though there are no analytical studies that compare the performances of the two. The individual results produced in isolation by the American and European researchers respectively, tend to lean towards their own experiences and therefore do not allow for accurate comparisons.

2.4.2 The South African Government Business Incubator Initiatives

The need for innovation is gathering momentum in South Africa as it is in most parts of the world. Innovation is the emerging buzzword for government and industry. Since the advent of democracy in 1994, policy-makers have been trying to stimulate economic development by promoting innovation commercialisation; and by also creating a vibrant and competitive entrepreneurial nation that is able to create job opportunities.

There are quite a few significant initiatives taken by both the South African government and private sector to stimulate local and provincial economic development and SMME growth. But there are only two government initiatives worth mentioning which focus on incubation of techno-entrepreneurs in the country, namely, the Godisa Incubator Programme and Tshumisano Technology Stations Programme.

Godisa, a Tshwana word meaning growth through nurturing, defines a development programme through which start-up firms are assisted to optimise technology and thereby improve the competitiveness of products and services. Tshumisano is a Venda and Northern Sotho word for partnership.

Godisa was born in 1999 and Tshumisano followed three years later, in 2002. This implies that South Africa embraced the incubation phenomenon 40 years after the birth of the first incubator in 1959.

To date, there are thirty five (35) various models of business incubators which are fully or partially sponsored by government and together they have supported more than 4 500 SMMEs (Godisa Annual Report, 2006).

Godisa incubators focus on low-tech innovations which are primarily in the second economy and Tshumisano incubators focus on high technology-based

SMMEs in selected sectors. Godisa and Tshumisano incubators are modeled around the European incubators because they were initially sponsored by the European Union and the German government respectively. Therefore the organisational structures and incubation programmes of these incubators were quite significantly influenced by Europe. As a result, these incubators offer services similar to those offered by the European incubators.

Godisa incubators were developed to address the following challenges: (i) economic growth; (ii) job creation; and (iii) equity. The idea of linking the universities, the research institutions and the business sector emerged in 2002 in South Africa (National R&D Strategy, 2002). Thus, Tshumisano's mandate at its birth was to accelerate the interaction between former Technikons and SMMEs particularly in the important area of technology transfer, training and skills development.

During the same year, the Gauteng Provincial government established a science park called the Innovation Hub to act as a link between the knowledge entrepreneurs, technology entrepreneurs and business sector. The Innovation Hub's incubation model is largely influenced by the American concept of science parks. The Hub also houses one of the country's most renowned hi-tech incubators called Maxum.

Incubation is a new phenomenon in South Africa as our incubators are all less than 10 years old. This is also evident from the minimal number of studies and reports available on the topic. Studies and reports that are publicly available are of normative nature and were either commissioned by the government (as policy-makers and sponsors) or written by the incubator managers (sharing own experiences and justifying the value-add of incubators). The reports do not offer a proper evaluation of the incubation phenomenon in South Africa because information available is limited, disaggregated and thus provide a partial view on the country's incubation sector.

2.5 THE DIFFERENT ORIENTATIONS OF RESEARCH STUDIES ON THE INCUBATION PHENOMENON

Many researchers have raised concerns that several studies on incubators created over the three decades are inconclusive with regard to the success of the incubators to reduce the mortality rate of start-up firms and the impact the incubators have made on the economies (Campbell & Allen, 1988; Allen & McCluskey; 1990; Albert & Gaynor, 2001; Kotelnikov, 2003; Veasley, 2003; Hackett & Dilts, 2004). The past studies provide incubator analysis focusing on physical space, sponsorship, model types, services offered to start-up firms, management features, screening criteria, incubation programmes, and incubator success rate.

Case studies reported mixed findings on what determines incubation success and could not come to any clear conclusion except that incubators are an essential strategic economic development tool and their impacts should be evaluated over both short- and long-term. The weakness of these studies was their failure to link the incubator success to state economy; number and quality of jobs created; and fiscal impact. The studies also lacked detail about the sites selected and data sources used.

The survey on incubation literature was conducted by Allen & McCluskey (1990) and Albert & Gaynor (2001). These researchers have grouped the existing literature on incubators around three main research orientations: evaluative, descriptive and prescriptive works.

Evaluative studies look at the factors such as job creation, start-up firm growth and success, location of firm after graduation, and increase in employment. These factors were used to determine the effectiveness of incubation programmes and their impact on economic growth. Albert & Gaynor (2001) concluded that the findings of the evaluative studies were the most complex to interpret because incubators have been created for different objectives. For

example, there are incubators that were established to create job opportunities and there are those that are linked to a university and focus on employing skilled graduates and the R&D commercialisation. This suggests that incubator success should be evaluated based on its mandate and objectives.

Descriptive studies initially focused on understanding different types of incubation models by defining and classifying incubators; analysing incubator entry criteria, sponsorships and services provided. The effort was mainly oriented towards qualitative case studies to show different interpretations employed by the actors for this policy instrument. Recent descriptive studies comprise of observations of specific cases with regard to the role these incubators play in socio-economic dynamics and also with regard to their adherence to pre-defined incubator critical success factors.

Prescriptive studies attempted to describe incubator success based on incubator best practices and performance of graduate client businesses and contribution of start-up firms towards economic development. These studies assessed incubator performance based on the effectiveness of management and organisational policies; value of services provided to start-up firms; survival of firms after graduation; and sustainability of jobs created. This is the only set of studies which emphasised the importance of start-up firms' performance in measuring incubator success.

2.6 THE DIFFERENCE BETWEEN BUSINESS AND TECHNOLOGY INCUBATORS

In order to understand a technology incubator we need to understand what a business incubator is. A business incubator is a physical facility created to provide business advice, services and support to up-coming and new entrepreneurs until such time they are independent and make profit. The main objective of incubators is to reduce failure rate of new businesses.

The more successful business incubator will provide the following:

- meeting rooms and/or conference facilities including flexible and affordable leases
- networking and commercial opportunities
- business planning and development - forming a company
- general office equipment
- marketing and financial advice
- pre-incubation programme
- intellectual property rights advice

The main difference between the business and technology incubators is that technology incubators have laboratories or technological facilities which make them expensive to support and maintain whereas business incubators offer a wide range of tangible and intangible services to their tenants which affect every aspect of a start-up firm. The second difference is that technology incubators have links with universities and research institutions; and they focus more on translating research and development (R&D) outcomes into products and services.

The NBIA report (2005) states that a technology incubator has more than 50 percent of its technology-oriented clientele participating in the incubation programme. For the purposes of this study, the Organisation for Economic Cooperation and Development (OECD) definition which combines Sherman (1998) and Tornatzky's (1996) definitions is adopted:

"A technology incubator gives the entrepreneur the place and time to develop the product, as well as access to skills and tools needed to create a successful business. It fosters the growth of firms involved in emerging technologies and has a primary objective of commercialising technology"
OECD (1999).

This definition is preferred for the present study because it captures the objective of the Innovation Hub's incubator and everything that the Hub offers to its start-up firms.

2.6.1 Precursors to Successful Technology Incubation

According to Veasley (2003), any incubation success depends on a committed visionary sponsor who understands how technology-based businesses grow. He further explains that technology incubators are successful if they operate within the following best practices such as:

- Creating value for industrial growth that would not otherwise occur;
- Assisting in diversifying the local economy and making it stronger;
- Developing and retaining successful local firms;
- Achieving government priorities for economic development;
- Promoting commercialisation of research and assist research institutions to be market driven;
- Maintaining close relationships with universities and research institutions;
- Utilising efficient and effective new technologies to support start-up firms;
- Conducting an outside audit of incubator finances annually; and
- Undertaking regular reviews and analysis of its clients against pre-defined financial criteria.

Literature on incubator 'success stories' is in abundance but what determines incubator success differs from author to author. Nevertheless, different researchers (Burger, 1999; Adkins et al, 2001; Albert & Gaynor, 2001; Veasley, 2003; Phan et al, 2005) agree that incubators have succeeded in fostering start-up firms' growth which in turn has created new jobs, increasing the survival rate of new firms, and in accelerating regional economic development. Despite the differences in defining the success factors, it is clear though that there are

conditions and/or practices that need to be in place to determine whether an incubator achieves its set goals or not.

In two separate studies, conducted by Kumar and Kumar (1997) and by Williamson (2003), to analyse precursors of incubator success, these authors established that incubator success depends on its ability to generate a high rate of successful start-up firms that are able to survive for more than three years after graduating from an incubator and create a high number of sustainable jobs.

The findings of Kumar & Kumar and Williamson are consistent with Veasley's and have been widely used to define the precursors for high-performing technology incubators. From these findings it is concluded that high-performing technology incubators:

- Have a well developed business case with pre-determined clientele and revenues;
- Receive stable funding and probably from various sources who have a long-term commitment to the incubator;
- Charge entrepreneurs minimal rental fees;
- Operate with larger budgets and have a full-time manager who is handsomely paid;
- Maintain networks with relevant professional service providers and local businesses;
- Have a linkage with a university or research institution;
- Have a clientele success rate of 80% and above;
- Create an environment which promotes client synergies;
- Conduct regular clientele performance assessments and review their business viability quarterly;
- Develop a focused vision, mission statement and objectives; and
- Adhere to generally accepted incubator standards and best practices.

The above-mentioned set of success precursors is used in this study to determine to what extent the Innovation Hub adheres to these identified precursors. By comparing the Innovation Hub to the identified precursors will expose areas that lead to improving the success rate of the Innovation Hub.

This study is located within the “*third generation*” incubation conceptual framework which is characterised by the mobilisation of ICT start-up firms. Accordingly, in this review, particular attention is paid to the incubation of ICT start-up firms. Hence the following section provides an overview of the ICT policies within the South African context and the objectives of the ICT incubators.

2.7 THE SOUTH AFRICAN POLICIES FOR THE INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) SECTOR

Like many other governments across the world, the South African government recognises information and communication technologies (ICTs) as essential tools for development. The ICTs are defined as “*the set of activities which facilitate by electronic means the processing, transmission and display of information*” (Rodriguez & Wilson, 2000).

Numerous policies developed in South Africa contribute to the development and production of new ICTs by promoting the growth of ICT-based industries. The new ICTs aim at increasing accessibility particularly to vulnerable and disadvantaged persons. The status of ICTs for socio-economic benefits is therefore high on the agenda of our country’s leadership.

In 1995 President Nelson Mandela, addressing the ITU Telecom-95 hosted by Geneva, emphasised the value of ICT and the importance of linking technology to people’s basic needs. In the same year, the then Deputy President, Thabo Mbeki invited the G7 Summit on the Information Society to the country “*to establish South Africa as an Information Society in which ICT tools are key*

drivers of economic and societal development” (DST Report on the G7 Summit on the Information Society, 1995).

In 2002, President Thabo Mbeki made a call for an ICT university to be established. He further challenged policy-makers to develop policies that foster productive investment in the ICT sector.

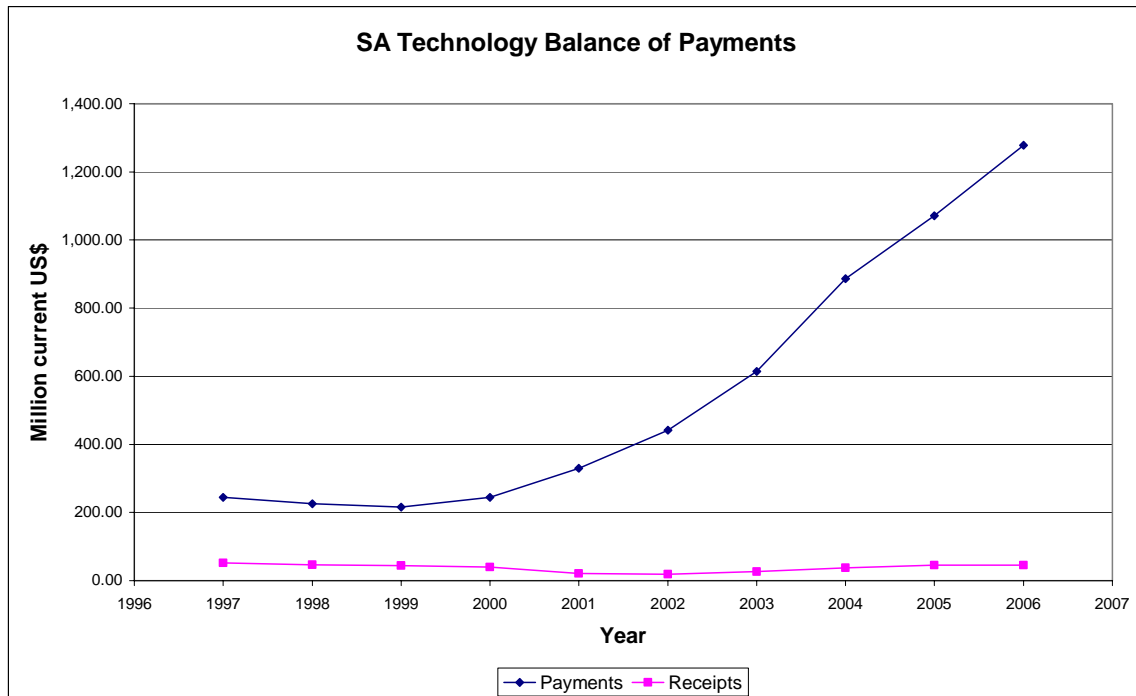
2.7.1 The South African Technology Balance of Payments

The Organisation for Economic Co-operation and Development (OECD) has been publishing the South African technology balance of payments (TBP) report since 1997. The TBP is defined as the measure of a country's ability to export and sell more of its technologies against purchasing foreign technology. The TBP is a useful tool for monitoring the changing profile of trade in intangible technology-intensive goods and services. The methodology of collecting the TBP data is not clearly defined and data is currently presented in an aggregated form and much underlying detail is obscured. Nonetheless, the TBP report (2006) indicates that South Africa is a technology colony which implies that our country is dependent on foreign technology for improving products and processes.

The TBP report (2006) further implies that the TBP on ICT does not favour South Africa mainly because there is less investment in ICT. The report findings revealed that South Africa's investment on ICT is approximately 10.5% as compared to 30% invested by leading OECD countries. One of the reasons cited for this low investment is that ICT investments take longer to yield profits as a result many efforts are unable to survive.

The graph below indicates how South Africa is spending on imported know-how.

Figure 2: The South African Technology Balance of Payments



Source: Organization for Economic Cooperation and Development, OECD stats (beta version) at <http://stats.oecd.org> 2007

The above graph depicts monies paid or received for the acquisition and use of patents, patent licences, non-patented inventions, trademarks, designs, know-how and closely related technical services, and also for the acquisition of R&D. Technology receipts and payments constitute the main form of disembodied technology diffusion reflecting all intangible transactions relating to trade in technological knowledge into and from South Africa.

From the graph, it is evident that, as a nation, we are importers and consumers of technology and very little is produced in the country which concurs with what the then Deputy President, Thabo Mbeki said in 1995 in his address to the G7 in Brussels:

“Like all developing countries, we are keen to acquire and grasp the technologies..... But we are also extremely interested to ensure that we

are not mere importers and consumers of a predetermined content. Rather, we also want to be producers and exporters of technology.....”
(DST Report on the G7 Summit on the Information Society, 1995)

To this effect, South Africa has identified ICT as one of the four pillars of the economy because it has the ability of influencing the productivity and competitiveness of other sectors. Few policies have been developed and implemented so that there is vibrant and sustainable ICT sector which is geared to improve the quality of lives and bridge the digital divide between the poor and the rich.

Two major policy documents developed were the Information Society and Development Plan and the ICT Research and Development (R&D) and Innovation Strategy. The South African ICT R&D and Innovation Strategy is geared to create more technology intensive small, medium and micro enterprises (SMMEs) and promote ICT incubation as an economic development tool.

2.7.2 The Information Society and Development (ISAD) Plan

The South African Information Society and Development Plan, developed in 2007, aims to ensure that the difference that ICTs make is both visible and measurable. The ISAD plan promotes entrepreneurship taking into account emerging SMMEs. It also identifies the following as priority focus areas for ICT application: (i) SMMEs; (ii) health; (iii) education and; (iv) government service delivery. These sectors were identified because they have a great potential for making a substantial contribution to South Africa's economic growth and can make a significant impact on people's lives.

The ISAD plan is also responsive to the development challenges facing the country. These are articulated in a number of reports, including the government

The 2005 Ten Year Review report on the implementation of government programmes since the advent of democracy in our country. Among these challenges are:

- high unemployment;
- minimal economic growth;
- lack of access to finance by the majority of public in general and SMMEs in particular;
- lack of critical skills;
- HIV/AIDS and other diseases;
- high illiteracy rate amongst certain racial groups;
- high poverty levels;
- inadequate preservation of cultural heritage; and
- State's inadequate capacity to deliver.

The first four challenges directly relate to this study and the ISAD implementation plan articulates measures to address them. The implementation plan proposes that interrelated measures such as (i) venture capital and micro-financing for SMMEs; (ii) government investment in incubators; (iii) strategies for promoting investment; supporting R&D networks; and (iv) establishing software parks be put in place.

Presently, the South African government is implementing a number of initiatives that involve the use of ICTs in its effort to (i) broaden participation; (ii) promote social inclusion and (iii) to better the lives of its citizens.

2.7.3 The Role of the National ICT R&D and Innovation Strategy

The Department of Science and Technology (DST) in collaboration with the Department of Communications developed, on behalf of the South African government, the ICT R&D and Innovation Strategy specifically for the ICT domain. The strategy aims at transforming South Africa from being a consumer

of ICT to a producer of ICT. This is done through the establishment of critical mass research programmes in specific areas and development of high-level human capital. The DST and the Department of Trade and Industry cooperate in ensuring that the outputs of critical mass research programmes support industry development (ICT Strategy, 2007).

The vision of the strategy for 2015 is to enhance the national system of innovation leading to an indigenous ICT sector that is developed, innovative and competitive which will further lead to marked increase in export of locally developed product and services. The strategy also focuses on the development of multi-disciplinary technologies, skills and methodologies to address areas of market neglect and to eradicate the digital divide (ICT Strategy, 2007).

During the strategy development process, several domains were identified as critical to supporting the objectives of government and as having potential for socio-economic development. Implementation of the ICT strategy is expected to yield a number of socio-economic benefits including:

- Contribution to poverty eradication through ICT applications to address basic needs.
- Integration of ICT into all aspects of society and the economy including smart infrastructure and effective service delivery.
- An exponential improvement in the knowledge and skills levels of South Africans brought about by effective utilisation of the benefits of ICT and the information society at all levels, from basic literacy to advanced technical qualifications.
- An innovative and sustainable indigenous ICT sector focusing on exports and contributing significantly to reducing the ICT balance of payment.
- Proliferation of ICT within other economic sectors such as mining, manufacturing, agriculture and tourism.

In line with global trends, the South African government has created under the Godisa Incubation programme, three ICT-focused incubators namely, Bodibeng

Technology, Gauteng Software both in Gauteng and Embizeni Innovation Support Centre in KwaZulu-Natal. The ICT-focused incubators' clientele base is 100% ICT and these ICT-focused incubators are very few in the world (Yarney, 2005).

The ICT-focused incubators promote individualism and therefore are supposed to develop business programmes that are customised to the individual needs of the ICT start-up firms. These ICT-focused incubators are envisaged to serve as the key structural intervention to support government in intensifying ICT innovation and thereby enhancing the country's capacity for local innovation and lessen dependence on imported know-how.

2.8 THE OBJECTIVES OF THE ICT INCUBATORS AS A STRATEGIC TOOL

Literature indicates that developing countries are still faced with enormous challenges of ensuring that their innovation efforts translate into useful and usable new technologies, products and services, which can be commercialised and boost local ICT industry (Marcelle, 2000; Yarney, 2005). These challenges are even greater in Africa because many states have yet to develop the "infostructure" and knowledge base that support the ICT sector (Yarney, 2005). One of the major initiatives proposed to address these challenges is the establishment of ICT incubators.

The ICT incubators are similar to technology incubators but with at least 80% of their clients specialising on ICT projects. Most ICT incubators will have about 20% of their start-up firms doing projects in other sectors such as biosciences, advanced manufacturing, chemistry and chemical engineering (Yarney, 2005).

New institution forms, such as the ICT incubators, are expected to harness new products and services to contribute to socio-economic development and bridge the chasm between the formal knowledge base and the ICT industry. The ICT incubators work towards removing the main barrier to the commercialisation of ICT innovations by providing to start-up firms better financial aid; a comprehensive package of highly skilled professionals; and an extended incubation period.

The role of the ICT incubators includes:

- Strengthening the competitiveness of the country's ICT sector;
- Improving the rate of commercialisation of ICT ideas and research and development (R&D);
- Increasing the success and survival rates of newly formed ICT businesses; and
- Developing linkages with R&D bodies, universities and other capital providers.

2.8.1 Objectives of the ICT Incubators

According to Yarney (2005), the broad-based objectives of the ICT incubators are to:

- Provide the primary bridge between the formal knowledge base and the real economy;
- Stimulate the development of ICT based services and products;
- Stimulate the development of ICT based enterprises – both public and private;
- Develop a significant ICT base for a country's economy;
- Provide an Intellectual Property support platform; and
- Facilitate the development of Human Capital for ICT Innovation.

2.9 CONCLUSION

Literature indicates that, to date, the incubators are the most common instruments used internationally to produce financially viable SMMEs and increase the success rate of SMMEs. Consequently, the number of countries establishing incubators is increasing. Because of this increase, new conceptual constructs for better understanding and measuring incubator performance are required.

There is a spectrum of literature on incubation but it mainly addresses the concept within the context of developed countries. Literature on developing countries is scarce but it reveals that the incubation models of developing countries are emulative of those in developed countries. Incubator models need to be based on local context and be compatible with existing development tools.

The literature also reveals that there is no linear model for incubation and incubation programmes are very complex to implement. The incubation performance has been evaluated by many researchers but the findings are difficult to interpret because different incubators have been established for different objectives under different social, economic and political conditions. The one message supported by the numerous literature reviewed is that incubators need government support to succeed, but should neither be considered nor managed as government projects.

Even though today we live in the *“third generation”* of incubation model which came into effect in 1999 and is supposed to focus on the mobilisation of the ICT sector, literature on ICT incubation is still very thin. The *“third generation”* incubators, particularly in developing countries, need a hybrid of innovative solutions to address challenges of poor ICT infrastructure, adverse investment environment, and weak governance structure. These incubators will therefore need to offer customised and comprehensive professional and technological

support for ICT start-up firms to meet their countries' conditions and needs. Government policy-makers, on the other hand, need to strengthen their infrastructure regulations and remove structural rigidities in the economy.

Critical success factors for ICT incubation programmes have not yet been fully developed although the framework developed by Kumar & Kumar and Williamson acts as a useful guideline for determining the critical success factors for effective incubation of ICT start-up firms.

The following chapter provides an overview of the research methodology chosen and the rationale for using the qualitative and descriptive single-case approach in this study. The methods employed for data gathering are also discussed.

Chapter 3

THE RESEARCH METHODOLOGY

3.1 INTRODUCTION

The research techniques and instruments used in the study are explained in this chapter. The researcher also describes a case study design within a qualitative paradigm as a strategy for undertaking descriptive research and why this approach is suitable for the objectives of this study. The adopted research methodology is thus determined by the nature of the study undertaken.

The chapter begins by examining the characteristics of the qualitative and quantitative methods. Thereafter, we justify the researcher's choice of a qualitative single-case approach to this study by first focusing on the advantages of using a qualitative method; and then reflecting on the viewpoint of a non-positivist with regard to a qualitative approach. Lastly, the researcher explains different forms of data gathering methods she used and how data will be presented.

3.2 THE CHARACTERISTICS OF THE QUALITATIVE AND QUANTITATIVE APPROACHES

Numerous studies indicate that qualitative and quantitative methods cannot be used in isolation but in conjunction with each other (Gillman, 2000; Kumar & Kumar, 1997; Maaga, 1992; Merriam, 1997). These studies argue that each approach operates within assumptions which differ from the other therefore each approach ought to be judged based on its own theoretical merits.

In contrast, there are researchers who believe that these two methods cannot be used together because the underlying assumptions are too different which makes integration of the two approaches impossible (Denzin & Lincoln, 2000; Hitchcock & Hughes, 1995).

Each mode of inquiry has its own pros and cons therefore the epistemological differences of all these researchers are, to a certain extent, relevant but unnecessary. The following table shows some of the divergences between the two approaches:

Table 2: Divergences between the Qualitative and Quantitative Approaches

Qualitative Approach	Quantitative Approach
Process-oriented	Outcome-oriented
Focus on narrative data	Focus on numerical data
Data analysis is narrative focusing on words/ideas thus associated with femininity	Data analysis is mainly statistical and associated with masculinity
Mainly employs a non-positivist paradigm	Mainly employs a positivist paradigm
Uniqueness- contributes to in-depth understanding of context	Generates generalisable data
Flexible natural setting thus unscientific	Highly controlled experimental setting thus scientific
Basically subjective with a researcher being immersed in the situation studied	It is objective because a researcher is mainly a non-influential observer
Applies inductive approach i.e. research begins by making observations then develop new theory	Applies deductive approach i.e. begins with known theory then test it

Source: Adapted from the Handbook of Qualitative Research by Adler & Adler, 1994

It is evident from the above table that the characteristics of the quantitative and qualitative techniques, though they are distinct from each other, they can and should co-exist as potential tools of the scientific research. Trying to find fault in one method only promotes a dichotomous debate of 'us better than them' and does very little to generate new knowledge.

There is a wide range of research that encompasses both approaches and cuts across these traditional demarcations (Creswell, 1994; Maaga, 1992; Merriam, 1988). Maaga (1992) suggests that researchers should focus on understanding when to use one methodology or the other or both and why.

Positive suggestions for combining quantitative and qualitative approaches are emerging even from some science-oriented disciplines. The leading scholars in the field of research on high-tech incubation profess the collaborative use of both types of techniques. (Allen & Weinberg, 1988; Campbell & Allen, 1988; Kotelnikov, 2003).

3.3 THE BASIS FOR THE USE OF QUALITATIVE RESEARCH

In this study, the researcher employed the qualitative approach, the basis for which is to provide further understanding of the incubation-incubator phenomenon especially within the ICT sector. The qualitative research methodology is preferred because it is used to (i) understand a subject and its contextual setting; (ii) evaluate effectiveness of a phenomenon; and (iii) develop new theories or strategies (Creswell, 1994).

The researcher's objective in this section is not to advocate one research tradition over the other. The researcher agrees with other scholars and acknowledges that both quantitative and qualitative methodological schools have an equally respectable place in scientific research.

Qualitative research is described differently by various researchers because it does not involve the same terminology as ordinary science. The common denominator in all these definitions is that qualitative research occurs in real life situations and it is in these situations that interviewees or subjects can provide in-depth information regarding a phenomenon (Creswell, 1994; Krueger, 1988; Newman, 1997). According to Newman (1997), qualitative research focuses on meanings, definitions, metaphors, symbols and descriptions of specific phenomena.

In qualitative research, a researcher is expected to directly interact with the subject or interviewee with a view of observing his/her expressions of emotion and gaining an understanding of the meaning the subject attaches to his/her real world (Krueger, 1988). This interaction enables a researcher to walk down avenues s/he did not anticipate travelling and open doors to new kinds of understanding (Creswell, 1994; Gillman, 2000).

3.3.1 The Purpose of Qualitative Research

The purpose of conducting a qualitative research is to gather information about people's world, experiences and their views of these experiences. Qualitative research attempts to capture aspects of the social world which are difficult to express in numerical measures (Maaga, 1992; Merriam, 1997; Newman, 1997). Just like in this study, the qualitative research approach yields data that cannot be manipulated mathematically.

A single-case qualitative approach is selected for this study because the research questions posed require an inquiry into a socio-economic intervention (Merriam, 1997) – in this case, the incubation-incubator intervention introduced

by government. The focus is on examining how and why this intervention succeeds or fails especially in the case of incubation of ICT start-up firms.

Therefore, qualitative research, in this study, aims at exploring and investigating the critical success factors for an effective incubation of ICT entrepreneurs and establishing challenges experienced by both incubators and incubatees in the incubation process.

3.3.2 A Non-positivist Perspective

Qualitative research reflects a non-positivist perspective which relies on the interpretive and critical approaches (Gillman, 2000; Newman, 1997). Newman supports the interpretive and critical paradigms because they emphasise the exploration of meaning and understanding in a specific context.

Newman argues that positivists regard qualitative data as a condition that causes measurable behaviour. The researcher of this study subscribes to the non-positivist ideology and agrees that qualitative researchers are not interested in converting data into objective numbers but view it as intrinsically meaningful depicting the relationship between sociological descriptions and actors' conceptions of their actions (Newman, 1997).

3.4 RESEARCH DESIGN

In designing a research study, the researcher decided on a single case methodology because it is ideal for providing a holistic and in-depth understanding into the incubation phenomenon. The researcher's choice for a single case study was also based on the knowledge that this methodology is very effective when investigating an existing theory (Yin, 2003). This choice is supported by Levy (1988) and Cavaye (1996) who confirmed that the use of a single-case methodology is the most appropriate for investigating the information technology concept.

A case refers to the research object or unit which is analysed. A case may be an event, situation, an entity or organisation, a person, a programme, an industry and a policy among many others (Yin, 2003). In this case study, the entity of analysis is a technology incubator called Maxum, which is located at the Innovation Hub in Pretoria.

3.4.1 The Rationale for a Case Study Methodology

Case studies are known for their ability to facilitate the understanding of complex real-life situations, portraying experiences lived in an entity or organisation and the results regarding a particular programme (Yin, 2003). They provide rich and meaningful data which cannot be attained through other methods.

Case methodology has been mostly used in the field of sociology particularly in the early 1900s up to 1935. This methodology was mainly used by social scientists to investigate poverty, unemployment and issues relating to immigration (Giddens, 1984; Tellis, 1997). Social scientists early adopted this qualitative research strategy especially to explore contemporary real-life situations in order to provide the basis for the development and application of new ideas and methods.

During this period, this was the method of choice and was ideal for addressing the social ills because it (i) was problem-oriented; (ii) provided in-depth understanding of complex real life activities; and (iii) incorporated the participants' views thus giving a voice to the voiceless and powerless (Tellis, 1997). The researchers in other fields also raised several problems and they too employed this particular technique to address issues in their disciplines.

The primacy of case study methodology coincided with the period during which the researchers and scholars in the field of sociology wanted to make this

discipline more scientific. The sociologists who were once advocates for this methodology became its worst critics. Case methodology lost its popularity and was criticised from all angles for not conforming to natural sciences' model and quantitative methods (Tellis, 1997). With an increased use of quantitative methods and analysis, the use of case methodology declined.

In the 1960s, there was a renewed interest in the case methodology primarily because researchers were becoming apprehensive about the limitations of quantitative approach and were questioning "the use of quantifying for the sake of it" (Hamel, Dufour & Fortin, 1993). Even those sociologists that were the champions of turning sociology into a scientific discipline were no longer pleased with the scientific mind-set and misapplication of the natural sciences' methods to social data and the overemphasis placed on statistical data at the expense of qualitative data.

Researchers began to appreciate that there is more to knowledge creation than objectivism and positivism. When presented with data and facts, researchers were able to look beyond patterns and frequencies of occurrences instead; they adopted an approach that attached meanings and constructions to the reality of peoples' experiences. Hamel et al (1993) purport that in pursuit of applying quantitative technique to research design; some researchers ignored unplanned consequences of a research study in favour of intended outcomes.

The criticism of the quantitative methods of analysis led to the decline of their dominance and some researchers were now using them cautiously. Researchers became more receptive to other methods of enquiry and it was during this period that two sociologists namely, Strauss and Glaser (1967) conceived the concept of grounded theory using case studies. This concept as well as other qualitative studies renewed the interest of using the case methodology and the methodology was again widely used in most disciplines.

Nowadays, case studies are primarily used to investigate contemporary issues focusing on determining why and how certain things happen (Yin, 2003). They are concerned with identifying the differences between what was planned and what happened in reality (Yin, 2003).

Case studies popularity and use has increased in recent decades. Case studies have been used in testing hypotheses in psychology, education, law and medicine (Tellis, 1997). Case studies have recently been gaining popularity in information system and information and communication technologies (Yin, 2003).

Yin (1993, 1994), Stake (1995) and Tellis (1997) observed that the biggest criticism of this methodology is that case studies lack of scientific rigorousness, comparability and replicability therefore there is no generality of findings. These researchers claim that generalisation is not a main issue in this kind of research, rather the relevance of a study is more significant than its proficiency to be generalised.

Yin (1993, 1994) argues that case studies do allow for generalisation particularly if two or more cases are incorporated within the same study and some of the case findings can “lead to some form of replication”. Stake, on the other hand, cautioned against putting too much emphasis on the generalisation because this may blunt the power of a case study.

Yin (1994) provided an argument for the use of case methodology, developed a set of guidelines which contains the general rules and procedures for undertaking case studies. Yin (1993, 1994) argues that case methodology as a research strategy is applicable to single or multiple case studies; and these studies can employ either a quantitative or qualitative approach or can be a mix of both.

Scholars who have a wide experience in the case study approach strongly argue that this methodology is as good as any other method in the scientific fields. The

literature of these scholars refutes conclusively the devaluing of a case study approach in any scientific investigation (Stake, 1998; Yin, 2003).

Based on the above arguments, the researcher used with confidence a single-case design to study the incubation-incubator phenomenon of the ICT start-up firms. The incubation-incubator phenomenon is very complex and a case study research is one method that is preferred to bring deeper understanding and add value to the existing knowledge about the incubation process particularly of ICT start-up firms.

The current study uses a descriptive single-case design for reasons stated in the following sections.

3.4.2 A Case for a Single-Case Research Strategy

A single case study is a research strategy preferred when one intends to investigate a particular unit of analysis, phenomenon or issue as compared to looking at the organisation in its entirety. Single case studies are therefore appropriate to probe in great depth an area of interest and are also useful when one wants to holistically understand a particular phenomenon, situation or problem focusing on addressing one or two issues that are critical to understanding a phenomenon or situation to be investigated. Hamel et al (1993) support this kind of strategy and see a single-case study as enabling the researcher to get a holistic perspective of a phenomenon under investigation.

Critics of this methodology feel that a small number of cases does not allow for generalisation. Others believe that an in-depth empirical enquiry of a phenomenon leads to subjectivity and biases the study findings. Some think single case study research is comparatively informal and is only valuable as an exploratory instrument. Giddens (1984) presented another criticism to the use of a single-case study as that it is very “microscopic because it lacked a sufficient number of cases”.

Hamel et al (1993) and Yin (1993, 1994, 2003) rejected and refuted these criticisms by strongly arguing that the singularity of the object of study does not make it any less authentic nor does a large sample convert a multiple case into a macroscopic study.

On the issue of bias, several renowned researchers such as Yin, Tellis, Stake and Hamel et al agree that it is impossible to completely eliminate bias in any research. They assert reports on natural sciences' studies are fraught with bias which is reflected in (i) the choice of subject for research; (ii) the chosen experiments; and (iii) the manner the experiment is carried out. Hamel et al (1993) further argue that natural sciences' studies often reveal more about the researcher's interests than the researched subject. Yin (1993, 1994) purports that bias is found everywhere, but can also be minimised. Yin claims that bias should be acknowledged; its implications recognised and the researcher should be prepared to live with those implications.

In order to enhance the reliability and validity of a single case study, Yin (1994) designed guidelines to be followed when conducting a single case investigation. Yin (1994) and Stake (1995, 1998) further recommend the use of multiple sources of evidence to enhance data reliability and emphasise that research findings should be presented in an honest manner and not simply support the prejudices and views of the researcher.

Literature on case study methodology is in abundance. Researchers have been using this methodology for many years; as a result case study reports from a variety of disciplines are also generally available in literature. Recently, single case studies have been a significant feature in studies involving information systems (Cavaye, 1996) and also those studies evaluating incubators (Rice 2002). Therefore, this study draws from the guidelines developed by Yin (1994) and Stake (1995, 1998) to use as a checklist when undertaking a single case study. The study also draws from the work of Walsham (1993) and Cavaye

(1996) who applied this methodology to evaluate information systems in organisations.

3.4.3 A Descriptive Single-Case Design

A descriptive method of research is where the person doing the research presents it in a descriptive manner. The descriptive research design enables researchers to describe or present a detailed picture of a phenomenon under investigation with no attempt to test or build theoretical models.

There are many examples of descriptive research; these include case studies, surveys, document analyses, job analyses, etc. Usually descriptive studies are used to develop hypotheses and these hypotheses are not further examined (Hitchcock & Hughes, 1995).

A descriptive single-case research therefore tests a phenomenon as it is known and yields qualitative data. It does not manipulate or modify variables investigated nor does it try to establish cause-effect relationships between these variables.

A descriptive single-case study was selected to enable the researcher to describe the incubation-incubator phenomenon and interpret the findings in a way that would provide greater insight into incubator success. According to Feagin, Orum and Sjoberg (1991), the case study methodology is ideal for bringing out the richness in descriptive studies.

This research replicates the study conducted by Buys and Mbewana (2007) in which they investigated the success factors of Godisa incubators in South Africa. Their study also employed a single-case research strategy. With this study, the researcher hopes to bring to the audience an understanding of a multifaceted issue and add to the existing literature on the incubation-incubator phenomenon.

3.4.4 Why the site was selected?

The case involved in this study was selected with utmost care. The Innovation Hub is the first internationally accredited science park in Africa. Science parks mainly promote larger-scale projects rather than an ordinary technology incubator. The Hub is therefore unique in that it also hosts a technology incubator, Maxum, which focuses on the development of SMMEs. The Innovation Hub is about 1.5 km away from the researcher's workplace which makes it easily accessible to the researcher.

3.4.5 How the subject was reached?

The researcher visited the Innovation Hub website to look for the contact details of the Innovation Hub's Chief Executive Officer (CEO). The first communiqué was addressed to the CEO and his Personal Assistant called a few days later and asked the researcher to address the letter to the Maxum's manager, Dr Jill Sawers who is the key decision-maker in the incubation process.

The researcher wrote to Dr Sawers on 10 May 2007 requesting permission to use Maxum as a case for her study and to conduct interviews. The very next day, Dr Jill Sawers called requiring further clarity on what the researcher wanted to do and achieve. Dr Sawers then signed the consent form which was faxed back to the researcher.

On 30 July 2007, the researcher called Dr Sawers's Personal Assistant to set up a date for an interview. The interview depended on Dr Sawers's availability who unfortunately keeps a very busy schedule. Our initial appointment was scheduled for the 4th September 2007 but the meeting was postponed to the 6th September 2007 because Dr Sawers had to attend another meeting in Cape Town.

3.4.6 Methods of Data Collection

Methods of data collection in a qualitative case study research are not fixed as in experimental research but they are unique and flexible. The strength of case studies lies with their ability to allow for utilisation of multiple sources and techniques for data gathering in order to enhance the findings (Gillman, 2000; Roger, 2000).

The researcher also used several sources of evidence which is useful for the triangulation of data. In this study, the researcher used the following methods to collect data:

- One-and a-half hour semi-structured interview with the Maxum's manager, Dr Jill Sawers on 6 September 2007. The purpose of the interview was to gather information and attach its meaning from the subject's perspective.
- Documents such as brochures, pamphlets, and the 2007 annual report were obtained from the Maxum's manager and these documents form part of the content analysis in the study. Other documents were downloaded from the Maxum's website.
- Site visit on 13 September 2007 to look around the Innovation Hub; interview incubatees and have informal interactions with the Innovation Hub's tenants.

The primary source of data was the interview provided by Dr Jill Sawers, a full-time incubator manager who spends most of her time on supporting and nurturing entrepreneurs. Through the use of open-ended questions, this interview provided depth and rich understanding of the complex incubation-incubator phenomenon. Dr Sawers is passionate about her work and this was evident in her thoughts, expression and gestures she made, especially when she talks about her clients.

On the day of the interview, Dr Sawers also provided the researcher with brochures, map, discs and an annual report. Dr Sawers occasionally made

references to the annual report and brochures to show the researcher certain important aspects.

On 13 September 2007, the researcher interviewed two Maxum ICT incubatees, one Maxum graduate using the same set of questions as those previously posed to Dr Sawers. The interview with the incubatees was spontaneous and flexible and it focused on their experiences in the incubator and interactions with other tenants. This data provided the researcher with deeper insight into the incubator's activities and entrepreneurs differences. The entrepreneurs did not want their true identity revealed; therefore they are referred to as 'Jim', 'Tebogo' and 'Sipho'. The entrepreneurs however consented to the use of a tape recorder. On the same day, the researcher had informal interviews with two Innovation Hub residents focusing on the role they play in the development of the young entrepreneurs.

The researcher visited the Innovation Hub website again on 15 September 2007 to download copies of annual reports, press releases and articles that have been written about the Innovation Hub and Maxum. Data contained in these documents was useful and informative but could not give that meaningful understanding obtained from a one-on-one interaction with Dr Sawers. The interview with Dr Sawers supplemented information that is not documented anywhere but is her own institutional memory.

3.5 THE TRANSCRIPT OF THE INTERVIEW WITH DR JILL SAWERS

The researcher listened and re-listened to the tapes in order to transcribe the interview held with Dr Jill Sawers and informal interview held with the entrepreneurs. This was a long and tedious process. The verbatim transcript adds depth, realism including perspectives of the interviewee. The transcript also responds to the research questions outlined in Chapter 1.

After transcribing the interview, the researcher took liberty of grouping similar concepts together in order to allow the narrative to flow. The researcher submitted the transcript to Dr Sawers for verification and validation. She returned it two-days later with minor changes effected in the text.

In the next chapter, the conversation analysis technique is employed with an attempt of telling a unique story of incubation within the Innovation Hub. Different voices of different actors narrate own viewpoints. The researcher uses the Monotype Corsiva font to differentiate the transcript of the interview from the actual content and other data of the study. The direct quotes of the interview held with 'Jim' and 'Sipho' are presented in the italic Comic Sans MS font. 'Tebogo' was shy and hardly said a word except to confirm what has been articulated by either 'Jim' or 'Sipho'. 'Jim' and 'Tebogo' are still at Maxum and 'Sipho' graduated in 2006.

3.6 CONCLUSION

In this chapter, the researcher described how the data was collected; who participated in the data gathering process; and how the participants were reached. She also explained why this study is grounded within a qualitative, descriptive single-case framework. The qualitative data produced provide a rich understanding of Maxum's incubation programme. The following chapter provides the analysis of data and interpretation of results.

Chapter 4

DATA ANALYSIS AND INTERPRETATION OF RESULTS

4.1 INTRODUCTION

In this chapter, data analysis and interpretation of results are presented. The researcher discusses qualitative data generated through interviews, document analysis and site visits.

When the researcher reaches the stage of data analysis, one would think that a lot of difficult work such as defining the research problem; identifying the object of the study; structuring interview questions; and data collecting has been completed. But still, organising and handling a large stack of raw data which included transcripts, reports, articles and field notes was an intimidating task.

According to Yin (1994), the case study analysis is not that well developed in the case study methodology and poses the most challenge to a researcher. As a researcher, I also experienced the same. I found that I had to present findings using various interpretations relying on my *“literature and own experience”* (Yin, 1994). The first challenge was to put data into logical and meaningful categories and find creative ways of presenting interpretations to the audience.

I read and then re-read the transcripts from Maxum's manager, Dr Sawers's interview and informal discussions with ICT incubatees and Innovation Hub tenants. After several readings of the data, working with it, organising and synthesising it, themes and patterns emerged which were then codified. The aim of this open coding process was to create descriptive codes for a preliminary analysis framework.

Analysis then began with tentatively identifying the conceptual categories and holistically examining them, discovering the important aspects and deciding what story to tell about the incubation-incubator phenomenon.

Reflecting on the critical questions posed in Chapter 1, I categorised the analysis and interpretation of data into the following:

- (i) challenges experienced by the incubator;
- (ii) challenges experienced by the ICT incubatees;
- (iii) factors critical to incubation success;
- (iv) steps to improve the success rate of incubated ICT entrepreneurs.

Therefore the analysis below focuses on the documents, site observations and is characterised by the use of the interviewees' quotes to respond to the critical questions.

4.2 ANALYSIS OF DATA

This present case study does not employ any statistical analysis. Yin (1994) states that "*statistical robustness is not an absolute necessity in all case studies*". Therefore the data analysis consisted of document analysis, observations made during site visits and how the incubator manager and entrepreneurs responded to the three critical questions of this study.

There are two perspectives that emerged from the interviews namely the incubator manager and entrepreneurs' perspectives. The analysis is thus characterised by the use of the incubator manager and entrepreneurs' own words.

4.2.1 Document Analysis

The data found in documents and records was cross-referenced with the data provided by Dr Sawers and the entrepreneurs. Both official and unofficial documents pertaining to the Innovation Hub and Maxum were analysed. An analysis of the annual reports revealed that Maxum is a successful and self-sustaining incubator which produces a relatively high percentage of SMMEs that graduate from the incubator. Maxum reported that their success rate is between 75% and 83% and they are currently sitting at 83% which is higher than 80% of international best practice. The success rate is calculated as the number of graduates multiplied by one hundred divided by the number of SMMEs who has been in the incubator for three years.

Maxum has incubated a cumulative total of 36 SMMEs since its inception in year 2000.. The average incubation period is three years, thereafter SMMEs graduate from the programme. By September 2007, 10 SMMEs had successfully graduated; other SMMEs have extended their incubation period whereas others did not make it due to market related or management reasons.

There are 190 jobs that have been created by ten SMMEs at a cost of R50 000 per job. The annual turnover of these ten SMMEs was R50 million as at June 2007. The table below indicates the cumulative increase in incubated companies and jobs created:

Table 3: Cumulative increase in incubated companies and jobs created

Year	Number of Companies	Number of staff (full/part-time)
2001	5	9
2002/03	11	38
2004	13	57
2005	23	97
2006	30	183
2007	36	190

Source: Adapted from Maxum's annual report 2007

Maxum information booklet outlines the objectives, services offered, incubation programmes and guidelines on how to apply for an incubation programme. Maxum's incubation programme is quite comprehensive and does not differ much from programmes offered in the USA or Europe. The booklet indicates that Maxum clients have access to government sources of funds such as Support Programme for Industrial Innovation (SPII), Gauteng Enterprise Propeller and Innovation Fund.

The newspaper articles revealed the then Gauteng Premier, Honourable Mbazima Shilowa lauding the Innovation Hub for having assisted government to achieve its goals for economic growth and how the Hub supports, nurtures and stimulates small businesses development through fostering economic diversification (The Business Day, 2005; Engineering News, 2007).

According to the NBIA (2003), a high-performing incubator will create 183 jobs from ten graduate companies with an annual turnover rate of \$26.3 million. The success of an incubator depends on its ability to attract the maximum number of clients; how well these firms perform and their performance as determined by the revenue generated and jobs created (Kumar & Kumar, 1997; Williamson, 2003).

Based on literature, Maxum is ranked as a high-performing incubator if we consider its success rate, the number of jobs created by 10 SMMEs, and the size of the South African population; and if we disregard other variables such as the Rand/dollar exchange rate and quality of jobs. Maxum's incubation programme compares well with international standards in terms of the type of infrastructure and services provided.

What the documents did not reveal though is how many graduate SMMEs have survived for at least three years after leaving Maxum. The data in the documents also did not indicate how many SMMEs have remained in the Gauteng province to contribute to the provincial economic development.

4.2.2 Observations from Site Visits

The Innovation Hub is the first internationally accredited science park in Africa. It is affectionately known as *"the smart place where smart people make tomorrow happen"* (Innovation Hub Annual Report, 2006). The Innovation Hub is home to 57 resident companies spread across six sectors namely, ICT, biosciences, electronics, engineering, smart manufacturing and professional services. This institution has turned Tshwane into a technology innovation hub.

In the past few years, I had visited the Innovation Hub because I either had a meeting or seminar or conference to attend. The state-of-the-art conference facilities offer a relaxed environment conducive to networking and collaboration and also provide cutting-edge technology and with flexible functionality.

When I visited the Hub on 13 September 2007, I saw it in a new light – the security guards on horse-back, palatial building, striking architecture, open air spaces for entertaining, people in the restaurant networking and/or entertaining clients, people strolling the piazza and a lot more.

The whole place was buzzing with energy. After taking a few rounds and photos, I went to the restaurant and immediately recognised 'Jim', a Maxum client whom I had met on 06 September 2007. He was with 'Tebogo', another entrepreneur and 'Sipho', a Maxum graduate of 2006. I requested to join them, introduced myself and informed them about the purpose of my visit. We chatted for about an hour and then they took me up to the Maxum business incubator.

I was overwhelmed by the passion and commitment the entrepreneurs have. Some of them left their permanent jobs to dedicate their time and resources in pursuit of a dream that may not be realised. Each entrepreneur occupies an office space which is about 20 square metres. The office space looks ordinary with a work station, computer and telephone. On that day, there were five entrepreneurs of which four wanted to start businesses in the ICT sector.

Maxum on its own is very bare and ordinary. But one has to look at the total package. It is the Innovation Hub, not Maxum, which provides a synergistic environment which stimulates networking and collaboration. Most of the Innovation Hub tenants are highly skilled knowledge workers who are at the forefront of research and development; and also regard innovation as their core business.

Therefore the Innovation Hub's physical facilities including Maxum structure are integral to an environment which *"promotes innovation and enhances competitiveness for knowledge-based businesses"* (Innovation Hub Annual Report, 2006). This environment is important in stimulating the creativity of technopreneurs and also in nurturing the type of business conducted at the Innovation Hub. Maxum however offers services that contribute to the long-term growth and sustainability of technology-intensive start-up firms.

The following sections, that is, 4.2.3; 4.2.4; and 4.2.5 respond to the critical questions of the study.

4.2.3 What are the Challenges faced by the ICT Incubators in their Facilitative Role for an Effective Incubation of ICT Start-up Firms?

4.2.3.1 Challenges Faced by Maxum

4.2.3.1.1 The Incubator Manager's Perspective

A: Getting Suitably Qualified Entrepreneurs

One of the challenges faced by Maxum is to have a maximum number of entrepreneurs entering into the incubation programme. Dr Sawers said they *“can accommodate a maximum of 20 companies in the Maxum business incubator but our intake fluctuates between 9-12 companies at any given time.”* One of the reasons for the low intake is that Maxum has set itself high entry criteria which most applicants fail to meet. These criteria are listed on the Maxum brochure and Dr Sawers, going through the brochure said: *“In order to enter into the incubation programme, entrepreneurs should have a feasible business plan which demonstrates these things. This is what we have listed here....* (pointing at the criteria listed in the brochure)*.... we expect to see all of this when we evaluate a business plan. For technological innovation in ICT or other focus areas i.e. they must offer a unique service. There must be evidence of:*

- *The feasibility of the business venture;*
- *The potential for the development of unique proprietary;*

- *High growth potential of the business venture;*
- *The potential to generate foreign revenue;*

But most importantly, the entrepreneurs are expected to relocate to Pretoria and commit to a lease for a year though there is flexibility- we do negotiate the termination of a lease should a need arise.”

The entrance criteria are relatively strenuous with entrepreneurs expected to have a workable business plan and a market focus. These criteria minimise the number of incubatees that enter into the incubation programme and therefore the incubator is often under-utilised.

Maxum’s *“biggest challenge as the incubator is to increase the number of qualifying incubatees especially from previously disadvantaged communities”*. Maxum needs to have focused recruitment programmes that will assist in getting more clients into the incubation programme. The more candidates enter the incubator, the more graduates it has.

B: Providing Sufficient Bandwidth

Maxum is unable to provide sufficient bandwidth. Dr Sawers said *“one other thing which our companies need if they are to compete in the international arena is inexpensive bandwidth”*. Maxum charges incubatees R300.00 for 8 kilobytes of bandwidth which is insufficient if they are going to be internationally competitive. The bandwidth allows entrepreneurs access to the internet to (i) browse the web; (ii) download information; and (iii) email. The bandwidth issue is an international challenge. The American technology incubators charge their entrepreneurs \$10 per month for 5 gigabytes (NBIA, 2003). Dr Sawers

recommends that *“our government should look into seriously reducing the cost of bandwidth if we want ICT start-up to succeed”*.

C: Sponsor Commitment

Maxum has a long-term contract with the Gauteng Provincial government which makes it one of the few lucky incubators. Most ICT incubators struggle to get funding commitment from sponsors thus sustainability and financing become a major challenge (Burger, 1999). Further funding is however required to assist the incubators and their clients with long-term sustainability. This is confirmed by Dr Sawers in the following transcript:

“An incubator can not operate on an annual contract, a constant source of funding needs to be guaranteed for sustainability. Whoever is supporting an incubator financially needs to understand that this is a long term process and must buy-in for a long term....the sponsor must be willing to commit funds to make the incubator successful.”

The operation costs for an incubator the size of Maxum are high. Maxum is struggling to raise sufficient funds for qualifying SMMEs and requires other funding options in order to support SMMEs.

4.2.3.1.1 The Entrepreneur's Perspective

A: Unpredictable Market Conditions

Jim and Sipho identified a few obstacles that may influence Maxum's ability to succeed. The first challenge is the uncertainty and complexity of the markets. In Sipho's words; *“No amount of incubation can fully prepare the entrepreneurs for the prevailing economic conditions that may jeopardize their businesses.”*

Sipho mentioned an important fact i.e. the timing when launching your business. His business was launched *"during the economic boom time and when the value of the rand is strong"*. But he cautioned that these conditions could change anytime and when *"that happens the SMMEs are the ones that would be hit hard"*. This statement further confirms that even though the success rate of Maxum is high, but the graduated SMMEs have not been tested how resilient they are against volatile economic conditions.

B: Addressing Entrepreneurs' Individual Needs

The second challenge is *"the risk that the incubator takes by investing in SMMEs"*. Maxum invests a lot of resources in entrepreneurs who are simply aspiring inventors with no guarantees that their business concepts will translate into self-sustaining firms.

The entrepreneurs' personal needs are also very diverse and *"the incubator cannot satisfy us all... we have different needs, products, and attitudes. Then there are people who are just complicated, selfish, disorganized, never meet deadlines..."* and this presents a challenge to Maxum. *"Some of us think that this place has to do everything and think we are entitled to success by virtue of being with Maxum"*.

One other challenge of the incubator is that of entrepreneurs who want to remain in the incubator even if it is time to leave. Jim concurs with Dr Sawers in pointing out that when some Maxum clients are expected to leave the incubator, they refuse to do so for different reasons. Maxum may feel that these clients have reached the level of financial viability and can stand on their own, but the client will have a different opinion. Jim thinks *"Maxum is like home away from home"*.

for uswhen it is time to go we feel like a baby-bird which is forced to leave its nest”.

4.2.3.2 Challenges Faced by ICT Start-up Firms

4.2.3.2.1 The Incubator Manager’s Perspective

A: Highly Competitive Markets

The ICT start-up firms or incubatees apply to join an incubator because they believe that they have a viable idea or dream. But they soon realise that *“having an idea is not enough to make one successful.”* For the success of this idea is largely dependent on its commercial value. Dr Sawers indicates that *“having an idea and taking it to the market are two different things.....Therefore one of the challenges of ICT clients is to keep up with highly competitive and dynamic market”*. The ICT sector is highly competitive and fluid in nature which makes it difficult to enter. Therefore the incubatees innovate without any guarantee that their innovations or businesses will succeed or not simply because there is no a priori knowledge on incubator success.

B: Lack of ICT Skills

Most of the ICT initiatives require the expertise of *“a programmer or someone with technical qualifications or expertise”* and this is a challenge. Highly skilled ICT people are scarce in South Africa and are very expensive. ICT and programming have been identified as scarce skills in the country and there are numerous programmes in place to address this (ICT R&D and Innovation Strategy, 2007).

C: Developing a Feasible Business Plan

Potential incubatees face a challenge of developing a feasible business plan. In her own words, Dr Sawers said *“most of the people that we turn away are because they do not have a business plan.”* However, Maxum offers two types of programmes namely the pre-incubation and incubation. *“The pre-incubation programme addresses the needs of clients who have a viable idea but have not yet developed a business plan..... The entrepreneurs will be mentored and exit the pre-incubation phase once their business plans clearly demonstrate the feasibility of a successful business and they may then enter the incubation programme.”*

What is not clear is whether those who enter the pre-incubation programme should have a useful idea and a poorly developed business plan or the emphasis is on the viability of an idea. If emphasis is on the valuable idea then more would gain access to the programme because developing a feasible business plan poses a bigger challenge to most entrepreneurs. According to Baron (2000), most entrepreneurs do not know how to develop a good business plan and that is their main downfall. But they are able to generate ideas based on the in-depth knowledge and experience gained in the field (Baron, 2000).

D: Access to Seed Capital

Challenges faced by ICT start-up firms include access to seed capital. ICT start-up firms approach Maxum because the incubator is willing to take a risk and invest in a new company before it becomes fully commercial. *“If clients come here, they get allocated a certain amount of money which is paid out if certain deliverables are achieved.”* Maxum has proven itself to be a reliable source of seed funding for ICT start-up firms who experience difficulty in accessing funding for their businesses even though this funding is insufficient. Lack of funding forces the entrepreneurs to take up part time consulting work to

earn more money but this *“distracts them from what they are supposed to be doing in terms of developing their own companies”*.

4.2.3.2.2 The Entrepreneur's Perspective

A: Lack of Business Acumen

Being an innovator does not necessarily mean that one is a good business man or woman. S/he may have technical expertise but still lack business acumen. A good, innovative idea still requires marketing and communication skills. Sipho stated that after entering the incubation programme, he knew that there was no stopping him *“because to be accepted in Maxum is a success on its own...you do not know how much it takes just to get here...”*

Sipho's wisdom was in realising that he is an innovator and not a shrewd businessman. He acknowledged that his biggest challenge was communicating with potential consumers and sponsors. He therefore employed a marketing manager for his business. His other limitation was in financial management. He spent a lot of time with the finance professionals in order to sharpen his financial skills. It took courage for Sipho to realise his own *“potential and weaknesses and was man enough to ask for help....The biggest mistake that we make is to think that we can be both innovators and businessmen at the same time. It is important to get people with complementary expertise to help you grow your business”*.

B: Protection of Intellectual Property

The entrepreneurs approach the incubator as individuals and not as a consortium mainly because they are trying to protect their intellectual property rights (Veasley, 2003). Other entrepreneurs prefer to go at it alone because they do not trust anyone with their intellectual property. Sipho reflected on how skeptical he

was to employ people to assist him because he *"would have to share every aspect of the business with them"*. On the other hand, Jim was afraid to submit his business plan to Maxum and regretted it the moment he did because *"this brilliant idea was no longer mine"*. After joining Maxum, Siphon and Jim met occasionally with an Intellectual Property specialist and after these meetings they are now very confident in Maxum's ability to protect the interests of its clients and in *"providing the best possible advice with regard to intellectual property management and helping us to avoid being threatened with lawsuits over trademarks' infringement"*.

C: Issues of Self-confidence

Even though Siphon had appointed someone to assist him he still grappled with issues of self-confidence and was *"afraid to lose control of my business and intellectual property rights"*. For him this business was his golden route to self-affirmation. He wanted *"to make a mark in this world, have something to call my own"*.

Siphon's Grade 12 results could not get him a bursary or entrance into a university. After doing odd jobs for three years, he wanted to prove to his family that he was worth something. Ironically, the place he disliked the most gave him a way out of his desolation. *"One day at my workplace, which I hated with my whole being, I got this brilliant idea which landed me here. That place has all sorts of first class high-tech equipment..... I even taught myself how to use a computer and by the time I had to develop a business plan for Maxum, I was already a computer pro"*. Siphon worked at this high-tech factory for eighteen months before coming to Maxum.

His business is progressing steadily and he is even thinking of growing his footprint. He estimated his annual turnover to be above R3.5 million. His glory is that he is making more money than his younger brother, *"the family Einstein"* who holds three university degrees. Sipho is now *"studying part-time through UNISA doing business management studies."*

Both Jim and Sipho agreed that for them *"to be an entrepreneur is not about economic growth but it is mainly about claiming one's identity"*. They felt that in order to gain self-respect they have to demonstrate their capabilities by creating and producing something that will be visible for all to see especially their families and friends.

For Jim and Sipho, they became entrepreneurs to pursue their own personal goals but they had to overcome personal problems such as lack of leadership skills, workplace challenges, fear and self-doubt, and above all they *"had personal scores to settle"*. This inner drive enabled them to take risks and choose a path that has never been walked by any member of their families.

4.2.3.3 Summary

There are challenges for both the ICT incubators and start-up firms and these inhibit the effective role of the incubators. Some of the incubators' challenges such as admission requirements are self-imposed and can be minimised. The first four challenges pertain to the incubators but they also affect the entrepreneurs. These challenges include:

- (i) the stringent entry criteria
- (ii) expensive bandwidth
- (iii) sustainability and financing
- (iv) ability of entrepreneurs to develop acceptable business plans
- (v) keeping up with fluid ICT industry

- (vi) access to technical expertise such as programmers
- (vii) lack of business and communication skills
- (viii) personal life experiences and self-realisation
- (ix) access to seed capital
- (x) protection of intellectual property

4.2.4 What Are the Critical Success Factors for an Effective Incubation within ICT Start-up Firms?

The United States Department of Commerce in collaboration with the National Business Incubation Association (NBIA) commissioned a study in April 2003 to benchmark technology incubator acumen, performance and practices. The study indicates that managers of top-performing incubators attributed the incubator's geographical location to its success. To locate an incubator within or adjacent to a *“major research university, medical institution, or federal laboratory, or in an otherwise resource-rich environment”* is critical (NBIA, 2003 p29).

4.2.4.1 The Incubator Manager's Perspective

A: Linkage with a University

Maxum is located in Tshwane, Pretoria *which “is already a knowledge-based city boasting of hosting seven of eight national science councils namely the CSIR, HSRC, NRF, ARC, SABS, NECSA and CGS. Most of the country's science and technology graduates are found here. We also have a good relationship with the University of Pretoria and Tshwane University of Technology.”* Because of its geographical location, Maxum clients have access to the universities' state-of-the-art laboratory equipment, technical expertise and low-cost workforce of graduate students.

Mian (1996) concluded in his study that an incubator's linkage with a university is indicated as a critical success factor in most studies because this relationship promotes research commercialisation. Therefore Maxum's affiliation with the University of Pretoria (UP) is significant to its success given that UP is one of the top research institutions in the country with a very strong technology transfer office (Maxum website, 2007).

The relationship between Maxum and the University of Pretoria was not investigated in this study. However, from the data collected one can cautiously conclude that Maxum's linkage with UP has very little in promoting research commercialisation but has contributed significantly in transferring business skills to start-up firms and in providing opportunities for students to enhance their own business skills. Most of Maxum incubatees are neither alumni nor researchers of the UP. The location of an incubator next to a university is to ensure that scientists and or researchers could pursue their business interests without leaving the academic environment. This solves the problem of scientific staff brain-drain which is a huge problem in our country.

Furthermore, the entrepreneurs interviewed made no mention of how the university benefited them or of ever using its facilities.

B: Financial Support

The support received from the provincial government is one of the critical success factors for an effective incubation. Maxum is one of the Gauteng Provincial government's initiatives to encourage high-tech SMMEs in order to create wealth and promote economic development. *"Maxum receives stable funding from the Gauteng Provincial government and other viable sources of financial support.... The Gauteng Provincial government had a vision of creating a 'smart city' which needs entrepreneurs and job creators."* The

Gauteng Provincial government committed funds to the incubation programme so that Maxum should improve the survival rate of new SMMEs by providing business advice, assist them to grow and transform their innovative ideas into viable businesses. Dr Sawers is grateful and appreciates the provincial government's commitment as she says *"In the province we have people who understand that incubation is a complex process and they support us in whatever we want to achieve."*

When clients join Maxum they are offered *"(i) office space, (ii) Telkom telephones, (iii) server, (iv) an opportunity to network among Innovation Hub's tenants and other business service providers and (v) access to resources through existing relationships with Gauteng Enterprise Propeller, SEDA, IDC, SPII, Adams and Adams Patent Attorneys, and People Business Executive Coaches."* These networks provide the clients with credibility and reputation which will assist them in attracting potential investors, consumers and employees. In return, Maxum gets a reputation of producing fast-growing start-up firms. Maxum places great value on client-to-client interactions and Dr Sawers emphasised the importance of maintaining an organisational culture which promotes such interactions. Therefore entrepreneurs which take up tenancy with Maxum benefit from a host of services, impressive facilities and a large network of relationships.

There is strong evidence that Maxum is a networked incubator because Dr Sawers has put systems in place to encourage networking and helping its clients to meet with potential business associates. Maxum has institutionalised its networking ability thus it provides *"preferential access to a network of potential partners"* (NBIA, 2003).

Maxum plays a critical role of nurturing start-up firms by providing high quality business support services. Maxum has developed a comprehensive incubation programme which focuses on pre-incubation and incubation. The incubation programme fosters financial management advice, business mentoring, marketing and communication expertise, and legal advice. Clients are allotted a business mentor who meets with the client on a monthly basis.

According to Dr Sawers, there are six critical success factors for an effective incubation of ICT entrepreneurs. These are presented in Dr Sawers's own words as follows:

(i) Mentorship: Maxum has a very good mentorship programme with highly qualified and experienced mentors. Our mentors have experience in running their own businesses and they understand what it takes to run a small business. They are both academics and entrepreneurs. They know what is required in cutting edge technologies environments. The selection of mentors is very critical because they would either make or break the start-up firms. They have experience in the establishment of start-up firms, business planning, finance and intellectual property management.

(ii) Branding: Companies come here because they believe that our reputation and brand is strong and will add value to their own companies. They want to be associated with Maxum because they have seen success cases coming out of this incubator and their clients know that they are in a supportive environment, hence reducing the risk of doing business with them.

(iii) Team: Maxum team is dedicated to the incubation of start-up firms. Entrepreneurs are very demanding people and require full time attention and dedication. Our employees are therefore not 8-to-5 employees. They are full-time employees and are passionate about assisting start-up businesses.

(iv) Funding: Longer term funding linked to the performance criteria is crucial. Maxum has a long-term commitment from its sponsors which makes us focus on our business because we do not have to worry about funding.

(v) Visibility: We also offer our client visibility and networking opportunities. Networks are integral to optimising the cluster value of the Hub's collegiate environment. At one stage we had a Strategic Team here from IBM and we introduced one of our clients to them. The client was so excited because he got exposure and he started doing business with them. We do a lot of things to link our clients to the markets.

(vi) Leadership and internship programme: Maxum has this programme to develop business skills of graduate and post-graduate students. We have partnered with the University of Pretoria and EPI-USE to launch an IT CoachLab. The partners have increased to include also MTN, The Resilience Company, Standard Bank, Tshwane University of Technology and UNISA, and the programme has successfully developed about 68 students for entry into the ICT sector.

4.2.4.2 The Entrepreneur's Perspective

Jim was a software developer for a big and profitable company for seven years before he decided to start his own business. He was overlooked for a promotion and this was the significant turning point in his life. By the time he came to Maxum he had already acquired business acumen and has been working on his innovative idea for two years.

A: Mentorship

Maxum offers a variety of business support services and Jim knew that the incubator environment would assist him to commercialise the product; by providing *"a mentor and emotional support from other clients.... You can not do this alone; you need every bit of help you can get"*.

Jim was aware of the broad value-add services and educational atmosphere that Maxum provides. But most importantly he knew that if he struggles with any aspect of business, Maxum will refer him to *"professional services such as legal experts, accountants, and marketing experts..... The best part of being here is that the staff understands our challenges and needs and they are always available to support us. Our mentors look after us as if their lives depend on our success"*.

Mentors are carefully selected and each mentor embodies unique qualities that make start-up firms thrive for success. The staff (and mentors) easily identify with the entrepreneurs because they have traveled down a similar road and they therefore know all the twists and cliffs along that path.

B: A Conducive Environment

It was a big image boost for Jim to lease sophisticated office space from Maxum because *"the next better option was to work from my garage"*. Jim's voice

trails off as he wonders what would have become of him had he not been admitted into the incubation programme. Jim believes that the investors would take him seriously working from such a superb environment.

Sipho confirms Jim's view point as he states *"The Innovation Hub is the heart and soul of my success.... The atmosphere of this place is conducive to my creative juices. What do you think I am doing here? I had a meeting with my mentor. Each time I want to try something new, I come here and this morning, my mentor and I were reviewing my marketing strategy"*.

ICT start-up firms choose Maxum because it has a good reputation and is good for their image. If a young entrepreneur is lodging in the Innovation Hub, this is proof that s/he is a hi-tech start-up.

C: Networking

When start-up firms join the incubation programme they interact with venture capitalists, suppliers and customers. This interaction exposes them to value-add networks that will benefit them in growing their businesses. Most studies emphasise the importance of networks to incubator success (Kumar & Kumar, 1997; Burger, 1999; Adkins et al, 2001; Albert & Gaynor, 2001; Veasley, 2003; Williamson, 2003; Phan et al, 2005). Sipho also confirms that *networks are vital in acquiring funding, expertise, equipment, and marketing opportunities and our access to formalized networks is crucial to Maxum's programme"*.

Sipho points out that it is extremely difficult to enumerate the success factors. He cited five factors that contributed the most to the success of his business, namely: *"(i) viable marketing strategy (ii) a conducive environment to innovativeness (iii) my personality and attitude (iv) networking opportunities and (v) a committed mentor"*.

According to Jim and Sipho the three most appreciated services provided by Maxum are access to (i) financial advisory services; (ii) seed capital funding; and (iii) networks with potential sponsors and customers.

4.2.4.3 Summary

The researcher's observation is that the critical success factors identified by the entrepreneurs focused on aspects that make their individual businesses succeed and not on what makes Maxum an effective incubator. Looking at these findings, it is difficult to believe that all entrepreneurs' needs could be supported by an incubator.

An incubator can provide an environment which stimulates innovation but creativity and innovation are personality traits which are inherent within an individual and cannot be taught. The personality characteristics are critical to incubation success but are difficult to identify thus the solution may be realised late. This raises a question: Should incubators consider personality characteristics in their screening criteria?

The following factors have been identified by Maxum's manager and entrepreneurs as critical to effective incubation:

- (i) mentorship
- (ii) branding
- (iii) team
- (iv) funding
- (v) visibility and networking
- (vi) leadership and internship programme
- (vii) geographical location
- (viii) political commitment and support
- (ix) business support services

- (x) entrepreneurial personality and quality

4.2.5 How Can Incubation Success Rate be improved in the ICT Start-up Firms?

4.2.5.1 Incubator Manager's Perspective

A: Reduce the Valley of Death

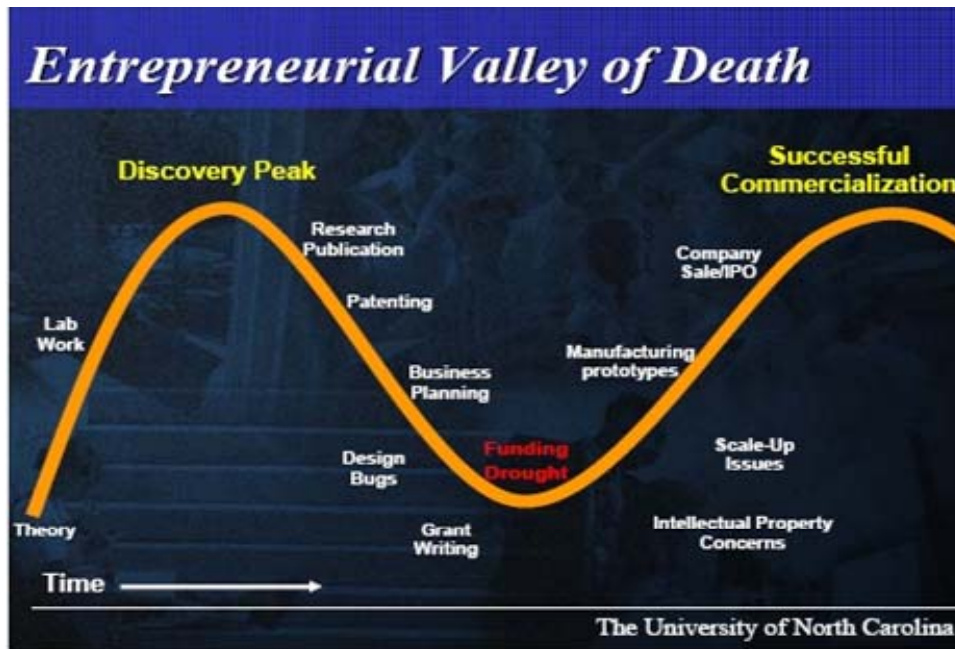
Dr Sawers cited *“the lack of funding and high cost of taking innovations to the market place”* as prohibitive to the success of an incubator. This is despite the government programmes such as the Innovation Fund, Support Programme for Industrial Innovation (SPII), Technology and Human Resources for Industry Programme (THRIP) and Small Enterprise Development Agency (SEDA) which all support SMMEs.

Most entrepreneurs approach Maxum *“because they are in need of financial support. Most of the existing funding schemes do not work for the entrepreneurs”*. When the entrepreneurs approach an incubator, most of them have one thought in mind – funding. They do not think about their business skills or lack thereof; they want to get their hands onto that sought-after funding before they too become statistics of the valley of death.

The valley of death is a funding drought period which befalls an entrepreneur after s/he has used up all his/her venture capital to establish a new business and there are no revenue streams yet. During this phase, an entrepreneur can neither raise more capital nor get credit to boost the cash-flow (Christensen, 1997). Most great innovations have been swallowed up by the valley of death before they even reach the haven of commercialisation (Lalkaka, 2003).

The following figure depicts an entrepreneurial valley of death.

Figure 3: An Entrepreneurial Valley of Death



Source: Presentation by Prof Edward Nesamvumi, 2008

In order to increase the success rate of its start-up firms and improve its own status as an incubator, *“Maxum needs to attract more start-up funds from private sector”* to help address and narrow the valley of death. Maxum should develop a pool of venture capital sponsors and this can only be realised if sponsors have reassurance in Maxum’s prowess to produce successful entrepreneurs.

B: Increase the Number of Incubatees

Dr Sawers indicated that Maxum is under-utilised. Maxum is able to accommodate 20 companies but the *“intake fluctuates between 9-12 companies at any given time”*. One of the reasons stated is that Maxum has set stringent criteria and the *“biggest challenge is to find those companies who*

meet our entry criteria". Therefore it is imperative that for "Maxum to increase its success rate, we should have more entrepreneurs entering the programme."

One would recommend that Maxum's management should consider relaxing the onerous entry criteria imposed on the entrepreneurs especially those from rural and disadvantaged communities. This will ensure that the number of incubatees increases and by default ensure maximum use of the facility.

4.2.5.2 The Entrepreneur's Perspective

A: A Formal Post-graduate Programme

Maxum, like any other incubator, offers a wide range of services to the incubatees such as financial management, human resource management, and marketing. But the entrepreneurs still feel that Maxum should provide continuous learning opportunities *"or a formal programme where graduate entrepreneurs meet to learn new ways of sustaining and maintaining businesses and to network"*.

Entrepreneurs' skills cannot be fully developed over the incubation period. These skills develop over time, often as the entrepreneur faces new challenges. A post-graduate programme is therefore essential, especially for ICT entrepreneurs who operate within a sector in which change occurs at a rapid pace and new solutions are often required.

Furthermore, entrepreneurs usually graduate when their businesses are financially sustainable. However, financial sustainability may not always be a good indicator of readiness for new graduates to operate independently. This post-graduate programme will thus offer them an opportunity to continue to learn from their mentors and share experiences with their fellow graduates. The

programme will thus prove to be invaluable while they acclimitise to the harsh reality of running a successful business.

B: Focused Investment

The entrepreneurs admit that most *"businesses do not see the day of light because they fail to attract investment to see them through the early stage of business"*. This clearly indicates that there is a need for sustainable and focused investment from both government and private sector that is targeting commercialisation of high risk ICT products and services.

C: Increase Maxum's Visibility

Sipho comes from a peri-urban community and he feels that institutions like Maxum are not known to these communities therefore *"Maxum needs to extend its visibility to rural and peri-urban communities surrounding Gauteng..... This will encourage these communities to come up with products that would add value to them"*. Getting this exposure will open doors to a large portion of the community to access the technology opportunities they need to address their own problems.

Most ICT products and services are of little use to these poor communities and these communities need programmes that are directed towards providing hi-tech solutions to their social and development challenges.

4.2.5.3 Summary

In order to improve the success rate of ICT start-ups incubation, the government needs to adopt a long-term approach towards innovation support. Government needs to enhance its facilitative role by providing a framework and developing the South African model based on the country's science and technology capacity,

competitiveness and cultural ethos. Dr Sawers recommends that *“government institutions should introduce more effective investment programmes and early-stage investment funds”* that would have a significant impact in bridging the valley of death.

The most evident requirement for improving success rate is venture funding. There is a need for a new strong funding mechanism such as the proposed Technology Innovation Agency (TIA) to be made available to incubators. TIA offers to provide seed and venture capital to SMMEs thus bridging the gap between start-up and acquisition of sponsor funding (DST Ten-Year Innovation Plan, 2007).

Whereas one acknowledges that entrepreneurship is not for everyone, but increased participation in the incubation programme will also increase the success rate. Maxum needs to encourage partnerships and alliances that lead to innovation and introduce recruitment programmes with a strong rural and peri-urban bias.

Maxum has successfully fostered a culture of cooperation and collaboration with the universities. There is now a strong and dynamic support base for SMMEs to partner with universities and leverage the knowledge generated by the universities and ensure that the universities' R&D translates to market products.

Two major predictors for incubator success are (i) the incubator is financially sustainable and (ii) its operations provide distinct value for the clients (NBIA, 2003). Maxum has largely met these predictors; documents' analysis, Dr Sawers and Maxum entrepreneurs all attest to this fact. Maxum entrepreneurs cannot have a better well-managed place to develop their entrepreneurial ideas and skills.

4.3 CONCLUSION

The Innovation Hub's incubator, Maxum, meets almost all the precursors for high-performing incubators as prescribed by the literature. There is one major challenge though. The Innovation Hub's incubation programme is similar to those in developed countries. The incubation programme has a set of entry criteria which mostly mirror those of developed and capitalised countries.

The South African context differs drastically from developed countries. In South Africa, there are fewer viable projects to choose from; most people do not know how to develop a business plan because they lack education; most people do not have business experience; and there is insufficient seed funding for start-up firms. Therefore having an incubator model that does not look at the country's diverse socio-economic challenges is a big oversight.

In this chapter, the data was analysed and the analysis focused on addressing the three research questions posed. The researcher presented the views of the incubator manager and entrepreneurs using their own words.

The following and last chapter of this journey presents the summary of research findings, and concludes with the limitations to the study and recommendations for further study.

Chapter 5

RESEARCH FINDINGS, LIMITATIONS AND RECOMMENDATIONS FOR FURTHER STUDY

5.1 INTRODUCTION

This research study aims at establishing the challenges experienced by the incubators and also at exploring the critical success factors for an effective incubation of ICT start-up firms. To accomplish the set objectives, the study employed a qualitative single case design and a technology incubator called Maxum was selected as a suitable site for the study.

SMMEs or start-up firms are responsible for creating new jobs; bringing new great ideas; and new innovative products and services into the market. The creation of new business and jobs is essential to an economy's ability to increase its gross domestic product and employment rate.

To start a new business in today's volatile economic environment is a challenge. It is also exciting but at the same time frustrating and infuriating. When start-up firms approach incubators they have all sorts of thoughts and therefore the incubators become bridge-builders into complex markets by providing strategic access to knowledge through networks and savvy mentors. If start-up firms apply for admission to an incubator, they gain access to professional services, office space, equipment and finance which are resources that are necessary to accelerate their growth and sustainability.

The Innovation Hub's incubator, Maxum, just like many other technology incubators provides the start-up firms with an assortment of resources and targeted services and its primary goal is to produce a high number of successful

and financially viable entrepreneurs. This goal is achievable provided all, if not most of, the critical success factors for effective incubation are met.

This final chapter provides the summary of the research findings outlining the challenges and critical success factors associated with the incubation of ICT start-up firms within the Innovation Hub. The inherent methodological limitations of the study are included and recommendations for further research are also suggested.

5.2 SUMMARY OF RESEARCH FINDINGS

Maxum is a multiple stakeholder organisation that provides a better dynamic incubation environment than a single stakeholder incubator. It is a specialised technology incubator that promotes largely ICT enterprises and is hosted by the Innovation Hub, a science park adjacent to the University of Pretoria. According to Williamson (2003), the stakeholders and location of an incubator are critical to its success.

The research findings of this study reveal that Maxum has the potential to produce financially viable SMMEs that can create new jobs. Maxum's clients are mostly ICT start-up firms hence the incubator has had more success in ICT than in any other sector. This success is largely attributed to strategically directed investment in people (i.e. staff, mentors, and professionals), incubator infrastructure and long-term relationships. However, there are challenges experienced by both the incubator and ICT start-up firms.

5.2.1 Challenges Faced by Maxum

- *Stringent Entry Criteria:* The first challenge involves the stringent entry criteria set by the incubator which the start-up firms have to meet if they want to be admitted into the incubation programme. According to Dr Sawers, Maxum selects about one in ten applicants into the programme. Maxum struggles to find those companies who meet the entry criteria as a result the incubator is not utilised to the fullest. Maxum's stringent screening process ensures that incubation candidates are de-risked considering that the incubator invests a lot more than money to develop entrepreneurs. However, this screening practice leads to fewer incubatees which further leads to the limited number of start-up firms that graduate which implies that fewer jobs will then be generated.
- *Insufficient Pool for Entrepreneurs:* Most people in the country do not know how to develop a good business plan because South Africa's school curriculum did not include entrepreneurship in the past and entrepreneurial courses have recently emerged in the universities. As a result, there is an insufficient pool for entrepreneurs and most South Africans do not think of themselves as business owners – this limits the number of people who dare to dream and enter into the incubation programmes.
- *Funding:* The third challenge is of attracting adequate funding from both government and the private sector. Funding is vital in sustaining the incubator and in ensuring that the start-up firms have access to venture capital which will prevent them from falling into the valley of death.
- *Highly Competitive Markets:* Fourthly, both incubators and start-up firms face the challenge of keeping up with highly competitive markets which leads to ineffective marketing of the products and/or services. This

problem is diverse and keeps on changing all the time. To a certain extent this inability has been the most common downfall of start-up firms.

- *Technical Deficiencies:* Lastly, ICT start-up firms face a challenge of technical deficiencies. South Africa has inadequate ICT infrastructure which leads to high internet connectivity costs. ICT specialists are also scarce, expensive and difficult to find.

5.2.2 Maxum's Critical Success Factors

According to Maxum's manager, Dr Sawers, Maxum's success rate is currently 83% which is above the 80% of international standards. Maxum is thus a highly successful incubator and its success is attributed to the following factors:

- *Conducive Environment:* The Innovation Hub's environment which exudes serenity is at the heart of Maxum's success by creating an atmosphere that promotes creativity and productivity.
- *Mentoring:* The ability of Maxum to closely match the entrepreneur's specific needs to a suitable mentor. The support provided is custom-made to suit the entrepreneurs' needs.
- *Professional Services:* Access to an array of valuable professional services and expertise which are designed to increase start-up firms' chances for success once they leave the incubator.
- *Financial Support:* Providing initial funding to start-up firms and linking them with 'angel investors' who also share their business experiences with the entrepreneurs, in addition to financial support.

- *Networking:* Developing strong networks with the Innovation Hub's tenants and large corporations which provide marketing pathways for start-up firms.

It must be noted that there has been no effort in this study to systematically appraise Maxum's success based on the performance of its graduate start-up firms. The researcher is bringing this up because she is of the opinion that the success of an incubator largely depends on the number of start-up firms it attracts and the performance of these firms after graduating from an incubator.

5.2.3 Ways to Improve Maxum's Success Rate

- *Long-term Investors:* ICT start-up firms are easy to incubate because they do not need large and expensive equipment for their inventions. Unlike the pharmaceuticals and biotechnology start-up firms, ICT start-ups do not need regulatory approvals for their products to hit the markets. But ICT markets are the most difficult to enter because of their fluidity and uncertainty as a result ICT investments take longer to yield high returns. Maxum therefore needs to consider getting investors committed to providing financial support to ICT start-up firms over a period longer than 5 years including post incubation.
- *Focused Pre-incubation Workshop:* Maxum offers a pre-incubation programme to applicants who have a commercially viable idea but do not have an effective business plan which outlines the critical factors that determine the business success. The pre-incubation programme should focus on building capacity to proletariat innovators especially those in rural and peri-urban communities even before their ideas are officially brought to the incubator. This pre-incubation programme could be in a form of a 3-4 day workshop in which aspiring innovators will be exposed to the know-

how and skills to transform their innovative ideas into feasible business plans. This target-oriented programme will enable the young innovators to understand the challenges they will face on their journey as they take their ideas from mind to market.

- *Incentives:* SMMEs are the government tool for job creation; unfortunately the job issue is not high on the entrepreneurs' agenda. The entrepreneurs' priorities are to make money and enrich themselves; earn recognition; and be your own boss. At Maxum, there is a need for an incentive programme that will encourage SMMEs to create new jobs. The incentive programme should consider the number and quality of jobs created. This means that another funding mechanism is required that will focus on promoting job creation.

5.3 LIMITATIONS OF THE STUDY

5.3.1 The study is limited to a single incubator therefore the research findings cannot be generalised and/or transferred to other technology incubators. The case study site is the only one in South Africa located in a science park and is not representative of other incubators either hosted by the universities or industrial estates.

5.3.2 Another possible limitation is that the incubation-incubator phenomenon is too recent in South Africa therefore the study could not determine the effectiveness of Maxum by examining the survival rate of the graduate SMMEs.

5.4 RECOMMENDATIONS FOR FURTHER RESEARCH

Most studies have limited timeframes and resources and these contribute to limitations which imply that there will always be a lot more of further research to

be undertaken. More studies are still required to expand our knowledge on the incubation-incubator phenomenon. The recommendations include the following:

- 5.4.1 The technology incubator studied is located within a science park and literature indicates that the location of an incubator is critical to its success. It would be helpful then to explore the incubation-incubator phenomenon from a different perspective. The recommendation is thus to investigate a technology incubator located within a university; or to undertake a comparative study of two incubators one hosted in a science park and the other in a research university.
- 5.4.2 Literature revealed that there is no single incubation programme that is applied universally across the SMMEs but most programmes have similar practices and services. Maxum's programme is no different from the rest. More research is required to investigate the effectiveness of the South African incubation programmes and to determine whether they are suitably adopted for a country in which two economies co-exist. The first economy is skilled, advanced and more globally competitive. The larger economically active population is unskilled, informal and marginalised and belongs to the second economy. The study will indicate whether our incubators are able to generate SMMEs that create substantial jobs in both economies.
- 5.4.3 South African incubators are relatively young and therefore do not have graduate SMMEs that have been in business for more than five years. Further research is recommended to investigate how many of Maxum's graduate SMMEs still exist after five years and how many survived the 2008/09 economic recession.

5.5 CONCLUSION

The establishment of incubators as an economic development tool offered South Africa an opportunity to build and keep its wealth and create new businesses that will translate to new jobs. Likewise, the Innovation Hub was established to stimulate the generation of new businesses and enterprises as well as creating an enabling environment for existing businesses by bringing in new knowledge and technologies.

The Innovation Hub's strategic objective is to support start-up firms in order to reduce their high mortality rate. The start-up firms on the other hand have two objectives, that is, (i) to generate economic growth and (ii) to create more jobs. Therefore, the Innovation Hub's success should be measured against these objectives within the South African context.

This study attempts to provide insight into the challenges and critical success factors for effective incubation of ICT start-up firms within the Innovation Hub. The Innovation Hub's incubation programme is similar to those offered by the American and European incubators. The challenges experienced by the Innovation Hub are not unique and the critical success factors match those prescribed in the framework developed by Kumar & Kumar (1997) and Williamson (2003).

Kumar & Kumar and Williamson's framework is based on incubators in developed countries. After literature survey, the researcher has identified a need to improve this framework and add the following three critical success factors:

(i) Enabling Government Policies: An incubator success depends on a stable political system that promotes hi-tech venture creation regardless of the inherent risks and also supports good technical infrastructure. It is therefore imperative for government to create an enabling policy environment for effective incubator performance.

(ii) *Local Context and Culture:* South Africa has a large population operating in the “second economy”. Incubation programmes and services should be based on local context and culture; building on existing structures and exploiting opportunities in the second economy.

(iii) *A Self-sustaining Incubator:* Incubators usually receive initial support from government but should strive to be self-sustaining. Just like the SMMEs, an incubator should also be managed as a business, have a full-time skilled manager and be financially viable.

The study indicates that the South African government is highly committed to the establishment of new hi-tech firms particularly in the ICT sector. However, there is a need for a new approach to ICT incubation. South Africa requires an ICT incubation programme that will encourage entrepreneurship among her citizens who will then develop ICT products that are of immediate use to the majority living in poverty. The government should therefore play a critical role by developing and enacting policies which support funding programmes to foster ICT start-up firms. ICT incubators, on the other hand, should develop and implement programmes that encompass our socio-economic values.

REFERENCES

Adkins D., Sherman H and Yost C. 2001. *Incubating in Rural Areas: Challenges and Keys to Success.* Sponsored by the Tennessee Valley Authority. NBIA Publications. Athens, Ohio.

Adler, P. A., and Adler, P. 1994. *Observational techniques.* In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research.* (p. 377-392). Thousand Oaks, CA: Sage Publications.

Ahuja G. and Katila R. 2001. *Technological Acquisitions and the Innovation Performance of Acquiring Firms.* *Strategic Management Journal* 15(3), pp 103-120.

Albert P. and Gaynor L. 2001. *Incubators: Growing up, Moving out - A Review of the Literature.* Cahiers de Recherche, Arpent.

Aldrich H. E. and Fiol C.M. 1994. *Fools rush in? The Institutional Context of Industry Creation.* *Academy of Management Review* 19(4), pp 645-670.

Allen D.N. and McCluskey R. 1990. *Structure, Policy, Services and Performance in the Business Incubator Industry.* *Entrepreneurship, Theory and Practice* 15(2), pp 61-77.

Allen D.N. and Weinberg M.L. 1988. *State Investment in Business Incubators.* *Public Administration Quarterly*, 12: pp 196-215.

Anand J. and Singh H. 1997. *Asset Deployment, Acquisitions and Corporate Strategy in Declining Industries.* *Strategic Management Journal* 18 Summer Special Issue: pp 99-118.

Badke W. 2000. *Case Studies in Research. In Research Strategies [On-line].* Available: www.acts.twu.ca/lbr/textbook.htm

Baron R. 2000. *Psychological Perspectives on Entrepreneurship: Cognitive and Social Factors in Entrepreneurs' Success*, 9: pp 15-18.

Bearse P. 1993. *The Evaluation of Business Incubation Projects*, National Business Incubator Association.

Brouwer J., Kleinknecht A. and Reijen J.O.N. 1993. *Employment Growth and Innovation at the Firm Level: An Empirical Study.* Journal of Evolutionary Economics 3, pp153 – 159.

Brusoni S., Prencipe A, et al. 2001. *Knowledge Specialization, Organizational Coupling, and the Boundaries of the Firm: Why do Firms Know More Than They Make?* Administrative Science Quarterly 46, pp 597-621.

Burger F. 1999. *Business Incubators: How Successful Are They?* Area Development Online.

Buys A.J. and Mbewana P.N. 2007. *Key Success Factors for Business Incubation in South Africa: The Godisa Case Study.* South African Journal of Science, vol.103.

Campbell C. and Allen D.N. 1988. *Change Agents in the New Economy: Business Incubators and Economic Development.* Minneapolis, Minnesota.

Campbell C. and Allen D.N. 1987. *The Small Business Incubator Industry: Micro-level Economic Development.* Economic Development Quarterly.

Cavaye A.L.M. 1996. *Case Study Research: A Multi-faceted Research Approach for IS.* Information Systems Journal, 6: 227-242.

Chan K.F. and Lau T. 2005. *Assessing Technology Incubator Programs in the Science Park: The Good, The Bad and The Ugly.* Technovation 25 (10), pp 1215-1228.

Chesbrough H. W. 2003. *Open Innovation: The New Imperative for Creating and Profiting from Technology.* Boston, MA: Harvard Business School Press.

Christensen C. M. 1997. *The Innovator's Dilemma.* Boston, MA: Harvard Business School Press.

Colombo M.G. and Delmastro M. 2002. *How Effective are Technology Incubators? Evidence from Italy.* Research Policy 31 (7), pp 1103-1122.

Creswell J.W. 1994. *Research Design: Qualitative and Quantitative Approaches.* California: Sage Publications.

Davila T., Epstein M. J. and Shelton R. 2006. *Making Innovation Work: How to Manage It, Measure It, and Profit from It.* Upper Saddle River: Wharton School Publishing.

Denzin N.K. and Lincoln Y.S., eds. 2000. *The Handbook of Qualitative Research.* Thousand Oak, CA: Sage Publications.

De Wet G. 2001. *Emerging from the Technology Colony: A View from the South.* Pretoria: Department of Engineering and Technology Management, University of Pretoria.

DST Annual Report. 2004. www.dst.gov.za.

DST Report on the G7 Summit on the Information Society 1995.

www.dst.gov.za

Duff A. 1987. *Best Practices in Business Incubator Management*. AUSTEP Strategic Partnering Pty. Ltd., Booragoon, Western Australia.

Eisenhardt K.M. 1989. *Building Theories from Case Study Research*. Academy of Management Review 14, pp 532-550.

Eisenhardt K. 1989. *Making Fast Strategic Decisions in High-Velocity Environments*. Academy of Management Journal 32(3), pp 543-576.

Eisenhardt K. M. and Schoonhoven C. B. 1996. *Resource-based View of Strategic Alliance Formation: Strategic and Social Effects in Entrepreneurial Firms*. Organization Science 7(2), pp 136-150.

Ettlie J. 2006. *Managing Innovation, Second Edition*. Butterworth-Heinemann, an imprint of Elsevier.

European Commission Enterprise Directorate General. 2002. *Benchmarking of Business Incubators*. Brussels

European Commission Enterprise Directorate General. 2005. *Measuring Economic Impact of Business Incubators*. Brussels

Feagin J, Orum A and Sjoberg G. (Eds.) 1991. *A case for Case Study*. Chapel Hill, NC: University of North Carolina Press.

Freel M.S. 2003. *Sectoral Patterns of Small Firm Innovation, Networking and Proximity*. Research Policy 32(5), pp 751-770.

Freeman C. 1982. *The Economics of Industrial Innovation (2nd edition)*, London: Pinter

Gene P., Greene J and Butler S. 1996. *The Minority Community as a Natural Business Incubator.* Journal of Business Research, 36(1), pp51-58

Gibaldi J. and Achtert W. S. (Eds.) 2004. *MLA Handbook for Writers of Research Papers.* New York: Modern Languages Association.

Giddens A. 1984. In Tellis W. 1997. *Introduction to Case Study. The Qualitative Report*, 3(2). Available at <http://www.nova.edu/ssss/QR/QR3-2>.

Gillman B. 2000. *Case Study Research Methods.* London Continuum.

Godisa 2004. *Introduction to the GODISA programme.* <http://www.godisa.net>

Godisa Annual Report 2006. <http://www.godisa.net>

Gray K., Coley W., Luta-Bingwa J., Mutai-Haimenyi B. and Oyugi L. 1996. *Entrepreneurship in Micro Enterprises.* University Press of America.

Grimaldi R. and Grandi A. 2005. *Business Incubators and New Venture Creation: An Assessment of Incubating Models.* Technovation, 25(2), pp111-121

Hackett S.M. and Dilts D.M. 2004. *A Systematic Review of Business Incubation Research.* The Journal of Technology Transfer 29(1), pp 55-82.

Hamel J., Dufour S. and Fortin D. 1993. *Case Study Methods.* Newbury Park, CA: Sage Publications.

Hattingh A. 2001. *Introduction to the GODISA Program,* Unpublished Correspondence.

Hitchcock G. and Hughes D. 1995. *Research and the Teacher: A Qualitative Introduction to School-based Research*. New York: Routledge. (pp. 77-112 on eRes)

Innovation Hub, *The Innovation Hub Business Incubator*,
<http://www.innovationhub.co.za/incubator.cfm>

Kingston W. 1977. *Innovation: The Creative Impulse in Human Progress*. John Calder Publishers Ltd, London.

Knopp L. 2006. *State of Business Incubation Industry*. Athens, Ohio: NBIA Publications.

Kotelnikov V. 2003. Business Incubators.
http://www.1000ventures.com/presentations/business_incubators.html.

Krueger R.A. 1988. *Focus Groups: A Practical Guide for Applied Research*. California. Sage Publications.

Kumar U. and Kumar V. 1997. *Incubating Technology: Best Practices*.
<http://www.nrc.ca/fptt/kumar.html>.

Kuratko D.F. and LaFollette 1987. *Small Business Incubators for Local Economic Development*, *Economic Development Review* 5(2), pp 49-55.

Lalkaka R. 2003. *Business Incubators in Developing Countries: Characteristics and Performance*. *International Journal of Entrepreneurship and Innovation Management* 3(1/2), pp 31–55.

Levy S. 1988. *Information Technologies in Universities: An Institutional Case Study*. Unpublished doctoral dissertation, Northern Arizona University, Flagstaff.

Lincoln Y. S. and Guba E. G. 1985. *Naturalistic Inquiry*. Beverly Hills, CA: Sage Publications, Inc.

Lofland J. and Lofland, L. H. 1984. *Analyzing Social Settings*. Belmont, CA: Wadsworth Publishing Company, Inc.

Luecke R. and Ralph K. 2003. *Managing Creativity and Innovation*. Boston, MA: Harvard Business School Press.

Lynos T.S. 1990. *Birthing Economic Development: How effective are Michigan's Business Incubators*. Center for the Redevelopment of Industrialised States, Michigan State University.

Maaga M.P. 1992. *Research Methods*. North West University. Mmabatho.

Magotsi R.M. 2006. *Extract from a Chapter of Proposed Book on Innovation and Enterprise*. Leadership Centre, University of KwaZulu-Natal.

Marcelle, G.M. 2000. *Gender, Justice and Information and Communication Technologies (ICTs)*. Paper presented at the 44th Session of the Commission on the Status of Women. NY. <http://www.undp.org/gender/resources/mono9.pdf>

Marshall C. and Rossman G. 1980. *Designing qualitative research*. Newbury Park, CA: Sage.

Maxwell J.A. 1996. *Qualitative Research Design: An Interactive Approach*. Thousand Oaks, CA. Sage.

Meeder R. 1993. *Forging the Incubator, How to Design and Implement a Feasibility Study for Business Incubation Programs*. NBIA Publications.

Merriam, S. B. 1988. *Case study research in education: A qualitative approach.* San Francisco: Jossey-Bass.

Merriam S. B. 1997. *Qualitative Research and Case Study.* Willey.

Merrifield D.B. 1987. *New Business Incubators.* Journal of Business Venturing 2(4), pp 277-284.

Mian S.A. 1994. *US University-sponsored Technology Incubators: An Overview of Management, Policies and Performance.* Technovation 14 (8), pp 515-528

Mian S.A. 1996. *The University Business Incubator: A Strategy for Developing New Research/Technology-based firms.* The Journal of High Technology Management Research, 7(2), pp 191-208

Mian S.A. 1996. *Assessing Value-added Contributions of University Technology Business Incubators to Tenant Firms.* Research Policy 25(3), pp 325-335.

Mian S.A. 1997. *Assessing and Managing the University Technology Business Incubator: An Integrative Framework.* Journal of Business Venturing 12(4), pp 251-285.

Miles M. and Huberman M. 1984. *Qualitative Data Analysis: A Source Book for New Methods.* Beverly Hills, CA: Sage Publications

Mouton J. 2001. *How to Succeed in your Master's and Doctoral Studies: A South African Guide and Resource Book.* Pretoria. Van Schaik.

Motloun T. 2006. Personal Interview on 28 May 2006, DST Offices, Pretoria.

National Business Incubation Association. 1991. *The State of the Business Incubation Industry*. Athens, Ohio:

National Business Incubation Association. 2003. *A National Benchmarking Analysis of Technology Business Incubator Performance and Practices*. U.S. Department of Commerce Technology Administration.

National Business Incubation Association website: www.nbia.org.

National ICT R&D and Innovation Strategy. 2007. www.dst.gov.za.

National Research and Development Strategy. 2002. www.dst.gov.za

Ndabeni L. 2005. *Strategies for Growth: The Supportive Role of Technology Incubators in Small Enterprise Development*. Institute for Economic Research on Innovation. Tshwane University of Technology.

Newman W.L. 1997. *Social Research Methods: Qualitative and Quantitative Approaches*. Third Edition. Boston, Allyn and Bacon.

OECD 1996. *Technology, Productivity, and Job Creation*, Vol 2. Analytical report. Organisation for Economic Co-operation and Development (OECD). Paris: OECD.

OECD. 1999. *Technology Incubators: Nurturing Small Firms*. OECD Publications, Paris.

OECD. 2006. *Technology Balance of Payments (TPB) Report*. OECD Publications, Paris.

Organization for Economic Cooperation and Development. 2007. OECD stats (beta version) at <http://stats.oecd.org>.

Oerlemans L.A.G., Buys A.J. and M.W. Pretorius M.W. 2001. *Research Design for the SA Innovation Survey 2001*. Paper presented at the Joint SA/OECD Seminar on Innovation Measurement, Pretoria.

Oerlemans L.A.G., Pretorius M.W.; Buys A.J. and Rooks G. 2003. *Industrial Innovation in South Africa. Report on the South African Innovation Survey for the period 1998 – 2000*. University of Pretoria: Pretoria.

Peshkin A. 2000. *The Nature of Interpretation in Qualitative Research*. Educational Researcher, 29(9), pp 5-10.

Peters L., Rice M. and Sundararajan M. 2004. *The Role of Incubators in the Entrepreneurial Process*. The Journal of Technology Transfer 29(1), pp 83-91.

Phan P.H., Siegel D.S. and Wright M. 2005. *Science Parks and Incubators: Observations, Synthesis and Future Research* Journal of Business Venturing 20(2), 165–182.

Phillips R.G. 2002. *Technology Business Incubators: How Effective as Technology Transfer Mechanisms?* Technology in Society, Volume 24(3), pp 299-316

Pianti M. 2003. *Innovation and Employment*. Handbook of Innovation. Oxford: Oxford University Press.

Ray G., Barney J.B. and Muhanna W.A. 2004. *Capabilities, Business Processes, and Competitive Advantage: Choosing the Dependent Variable in*

Empirical Tests of the Resource-based View. Strategic Management Journal 25 (1), pp 23-37.

Rice M. and Matthews J. 1995. *Growing New Ventures, Creating New Jobs: Principles and Practices of Successful Business Incubation*, National Business Incubator Association.

Rice M.P. 2002. *Co-production of Business Assistance in Business Incubators: An Exploratory Study*. Journal of Business Venturing, 17(2), pp 163-187.

Ritchie J. and Lewis J. (eds) 2003. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London, Sage.

Roberts E.B. (eds) 1987. *Generating Technological Innovation*. Oxford University Press, Oxford.

Rodriguez F. and Wilson E. 2000. *Are Poor Countries Losing the Information Revolution?* Washington DC. www.infodev.org/library/working.htm

Roger G. (Ed.) 2000. *Case Study Method: Key Issues*. Sage.

Rogers E. 1995. *Diffusion of Innovations*. 4th edition New York: Free Press

Ronstadt R. 1986. *Entrepreneurship*. Lord Publishing.

Rothaermel F.T. and Thursby M. 2005. *University-incubator Firm Knowledge Flows: Assessing their Impact on Incubator Firm Performance*. Research Policy 34(3), pp 305-320.

Schumpeter J. 1934. *The Theory of Economic Development*. Harvard.

Seale C. 1999. *The Quality of Qualitative Research*. London: Sage.

Sherman H. and Chappell D.S. 1998. *Methodological Challenges in Evaluating Business Incubator Outcomes*. *Economic Development Quarterly* 12(4), pp 313-321.

Silverstein D., DeCarlo N. and Slocum M. 2005. *In-sourcing Innovation: How to Transform Business as Usual into Business as Exceptional*. Longmont, CO: Breakthrough Performance Press.

Smith J. K. 1990. *Alternative Research Paradigms and The Problem of Criteria*. In E.G. Guba (Ed.), *The paradigm dialog* (p. 167-187). London: Sage.

Snow D.A. and Anderson L. 1991. *Researching the Homeless: The Characteristic Features and Virtues of the Case Study*, in J.R. Feagin, A.M. Orum, and G.Sjoberg (Eds.), *A Case for the Case Study*.

Stake R. 1994. Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research*. (p. 236-247). Thousand Oaks, CA: Sage Publications.

Stake R. 1995. *The Art of Case Research*. Newbury Park, CA: Sage Publications.

Stake R. 1998. *The Art of Case Research*. Newbury Park, CA: Sage Publications.

Stallings W. M. 1995. *Confessions of a Quantitative Educational Researcher Trying to Teach Qualitative Research*. *Educational Researcher*, 24(3), pp 31-32.

Strauss A. and Corbin J. 1990. *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage Publications, Inc.

Strauss A. and Glaser B. 1967. *The Discovery of Grounded Theory: Strategies of Qualitative Research*. Chicago: Aldine.

Tellis W. 1997. *Application of a Case Study Methodology: The Qualitative Report*, 3(3.) Available at <http://www.nova.edu/ssss/QR/QR3-3>.

Tellis W. 1997. *Introduction to Case Study. The Qualitative Report*, 3(2). Available at <http://www.nova.edu/ssss/QR/QR3-2>.

Ten Year Innovation Plan for South Africa. 2008. www.dst.gov.za

The South African ICT Research and Development and Innovation Strategy. 2007. www.dst.gov.za

Tornatzky L.G. 1996. *The Art and Craft of Technology Business Incubators*. The Southern Technology Council and NBIA, Boston.

Tshumisano Annual Report. 2007. www.dst.gov.za.

Udell G.G. 1990. *Are Business Incubators really Creating New Jobs by Creating New business and New products?* *Journal of Product Innovation Management*, 7(2), pp 108-122

UNDP. 2001. *Human Development Report: Making New Technologies Work for Human Development*, New York.

UNIDO. 2002. *Industrial Development Report*, published by UNIDO, Vienna, June/July 2002.

Veasley D. 2003. *Incubators Build Economies, Benefit Communities*. <http://Birmingham.bizjournals.com/Birmingham/stories>.

Walsham G 1993. *Interpreting Informations Systems in Organisations*. Chichester: Wiley.

White Paper on Science and Technology. 1996. <http://www.dst.gov.za>.

Williamson E.L. 2003. *North Carolina Small Business Incubators: What are the Precursors to their Success as an Economic Development Strategy?* University of North Carolina, Chapel Hill

Yarney J. 2005. *Africa looks to Incubators to Spark ICT*. www.gov.mu/portal/goc/ncb/file/Africa

Yin R. K. 1989a. *Case Study Research: Design and Methods (Rev.ed.)*. Beverly Hills, CA: Sage Publications.

Yin R. K. 1993. *Applications of Case Study Research*. Newbury Park, CA: Sage Publications.

Yin R. K. 1994. *Case Study Research, Design and Methods (2nd ed.)*. Thousand Oaks, CA: Sage Publications.

Yin R. K. 2003. *Case Study Research, Design and Methods (Rev.ed.)*. Sage Publications.

Appendix A



Dr Jill Sawers
The Manager: Maxum Business Incubator
Innovation Hub
P.O. Box 1
PRETORIA
0087

Fax: 012- 844 1107

Dear Madam

REQUEST TO CONDUCT RESEARCH USING THE INNOVATION HUB AS A CASE STUDY

I am a MCom: Knowledge and Innovation student registered with the University of KwaZulu-Natal. I am currently employed by the Department of Science and Technology as a manager: Sector R&D Planning. As part of the Master's programme I am expected to do a research project. I completed coursework last year and am now preparing for doing research. The research proposal was presented to the university's Higher Degrees and Research Committee and was approved.

The aim of this letter is to request you to grant me access to the Innovation Hub's incubator, Maxum to conduct interviews and for observation. On 12 April 2006, Innovation Hub celebrated the graduation of the first seven companies from their incubation programme. Innovation Hub has been selected for this case study research for its proximity and success. My research title is: Taking ideas from mind to market: Challenges and Critical Success Factors for Effective Incubation of ICT Start-up Firms within the Innovation Hub.

The study is aimed at answering following research questions:

- What are the challenges faced by the ICT incubators in their facilitative role for an effective incubation of ICT start-up firms?
- What are the critical success factors for an effective incubation within ICT start-up firms?

- How can incubation success rate be improved in the ICT start-up firms?

If you agree to participate in this project, you are requested to sign the declaration below and fax to 086 681 0203. For more information, please call me at (012) 843 6411 or 082 523 4931.

Thanking you in advance

Yours Sincerely

Nonkululeko YZ Shinga (Ms)

.....

DECLARATION

I.....(full names of participant) hereby confirm that I understand the contents of this letter and the nature of the research project, and I consent to participating in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

SIGNATURE OF PARTICIPANT

DATE

.....

Appendix B (Signed Declaration)

Appendix C

INTERVIEW QUESTIONS

General Information

1. What is the role of the Maxum as an incubator?
2. What are the key factors involved in the decision to incubate?
3. How does the Maxum incubator compare or differ from other incubators?
4. How is the incubator funded?
5. Where does the Maxum business incubator fit within the Innovation Hub?
6. What services does the Maxum incubator provide and how are they provided? What needs and gaps does the incubator address?
7. How best does Maxum serve the local market and conditions?
8. Does the incubator provide access to the Innovation Hub resources?
9. What other organisations does the incubator work with?
10. How do your clients get to know about your programme? What is the application process?
11. What are the qualifications to be an incubator client?
12. Does Maxum accept only companies in certain technology areas?
13. Where do the innovators get information that leads to the development and introduction of new products?

Role of Maxum in the incubation process of ICT firms

14. Is there a difference between an ICT incubatee and biotechnology incubatee?
15. Do you have a different programme for the ICT incubatees? If yes, how is it different from other programmes?
16. How do ICT incubatees' ideas about innovation and business management change once they are exposed to the incubation process?
17. What channels did the ICT innovators most often use to gain access to new technology?

18. What channels did the ICT innovators most often use to transfer new technologies out of the enterprise?
19. What methods did the ICT innovators employ to appropriate the benefits of their new innovations?
20. How important is R&D to the innovation process?
21. Did R&D or other innovative activities involve external partners?
22. What is the government's role in encouraging the development of incubators?

Challenges

23. What unique problems arise in managing Maxum?
24. What solution does Maxum typically try and with what success?
25. How does Maxum cope with problems that have no solution?
26. Do you as the incubator manager work full time on Maxum activities and developing client businesses?