

AN ANALYSIS OF TECHNOLOGY SUPPORT SERVICES FOR SMALL AND MEDIUM SIZED ENTERPRISES IN SELECTED INDUSTRIAL PARKS OF PRETORIA

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ABSTRACT

This research project provides an overview of the South African unemployment challenge as well as the various options considered to address this challenge, of which one is the utilization of the Small, Medium and Micro Enterprises (SMME) Sector. A detailed description of the government approach in using the SMME sector as a vehicle for addressing unemployment is provided. The Department of Trade and Industry (DTI), which is the lead department responsible for driving the SMME sector is discussed as well as the supporting technology role of the Department of Science and Technology (DST). The research reviews major SMME policy interventions emanating from both the DTI and DST, particularly after 1994. The broader role of SMMEs in an economy is also discussed with a particular focus on developing countries such as South Africa. This includes:

- a description of the various roles SMMEs can play in an economy;
- an overview of key SMME policy interventions post 1994;
- the problem statement; and
- a discussion of the research objectives, with reference to the primary objectives as well as the secondary objectives.

The research further provides an overview of the research method followed, the process followed in acquiring data, and the boundaries and limitations of the research project. Further to this, a brief overview of the mini-dissertation is also provided.

The research proceeds to provide a perspective of the South African technology challenge “the innovation chasm”, as well as alternatives that could be pursued by government in addressing these challenges in Chapter 2. The research provides a description of technology challenges faced by South Africa and how these technology limitations manifest themselves in the SMME sector as reflected on the technology S-curve. A limited international overview of various SMME technology transfer programmes and institutions used is also provided. The research provides a detailed analysis of SMME support interventions across the various spheres of the South African

government; key line function departments are identified as well as their respective policies, programmes and institutional support.

The study is supported by literature and empirical research. The empirical research was mainly a questionnaire designed and implemented to gather empirical data as defined in the problem statement as well as in the two research objectives. The first focal area of the empirical research was the identification of the types of SMMEs operating in the industrial complexes which were selected for the study. In this regard, the set of questions was designed to solicit information pertaining to critical attributes of SMMEs as determined by the DTI classification. The survey then focused on elucidating the technology management modalities of SMMEs as well as how these related to the current government-led SMME technology interventions. As per the problem statement, the survey then concludes by investigating technology development within the SMME sector.

The research project concludes by considering and evaluating key findings emanating from both the literature survey as well as the empirical research that was conducted during the course of the study. The **literature study** as well as the **empirical research** both leads to the same conclusion regarding the problem statement of the weaknesses in SMME technology support and technology development. On the basis of the literature survey and empirical research findings, the following conclusions were then reached:

- The current government SMME technology interventions do not adequately meet the technology needs of the SMMEs; and
- There is insufficient or lack of technology development within the SMME sector.

Limitations of the current interventions relating to technology development were then identified, as well as a recommendation on a set of interventions that could be employed to reverse this negative trend. In addition to these recommendations, a proposal is made on possible future research areas for further investigations which could complement the findings of the current research project.

List of key terms: SMMEs, technology development, technology interventions, government initiatives, unemployment.

OPSOMMING

Hierdie navorsingstudie gee 'n oorsig van die Suid-Afrikaanse werkloosheidsvraagstuk sowel as die verskeie oplossings wat hierdie uitdaging die hoof kan bied, waarvan een die KMMO-sektor is. 'n Gedetailleerde beskrywing van die regering se benadering om die KMMO-sektor te gebruik as voertuig om werkloosheid op te los, word gegee. Die Departement van Handel en Nywerheid (DHN) wat die stukrag in die KMMO-sektor is sowel as die ondersteunende tegnologierol van die Departement van Wetenskap en Tegnologie (DWT) word bespreek. Die studie fokus voorts op die groot KMMO-beleidsintervensies wat deur die DHN en DWT voortgebring is, veral na 1994. Die breër rol wat KMMO's in die ekonomie speel, word onder die loep geplaas, met spesifieke verwysing na ontwikkelende lande soos Suid-Afrika. Dit sluit in:

- 'n beskrywing van die onderskeie rolle wat KMMO's kan speel in 'n ekonomie;
- 'n oorsig van die sleutelbeleid oor KMMO-intervensies na 1994;
- die probleemstelling; en
- 'n bespreking van die navorsingsdoelstellings, met spesifieke verwysing na die primêre doelstellings en die sekondêre doelstellings.

Die studie voorsien ook 'n oorsig van die navorsingsmetodologie wat gevolg is in die proses om data in te samel, en die grense en beperkinge van die studie. Voorts word 'n kort oorsig van die mini-dissertasie verskaf.

Die studie gee perspektief oor die uitdaging waarna verwys word as “die innovasiegaping”, sowel as alternatiewe wat die regering kan oorweeg om die uitdagings soos in hoofstuk 2 uiteengesit, die hoof te bied. Die navorsing verskaf 'n beskrywing van tegnologie-uitdagings wat Suid-Afrika in die gesig staar, en hoe tegnologiebeperkinge manifesteer in die KMMO-sektor soos dit gereflekteer word op die tegnologie S-kurwe. 'n Beperkte internasionale oorsig van verskeie KMMO-tegnologieoordragprogramme en -instellings word aangebied. Die navorsing voorsien ook 'n gedetailleerde analise van KMMO-ondersteuningsintervensies oor die spektrum van die Suid-Afrikaanse regering;

sleutellynfunksiedepartemente word geïdentifiseer sowel as hul onderskeie beleide, programme en die institusionele ondersteuning wat hulle bied.

Die studie word ondersteun deur empiriese navorsing wat hoofsaaklik bestaan uit 'n vraelys wat ontwerp en geïmplementeer is om data in te samel, soos gedefinieer in die probleemstelling en die twee navorsingsdoelstellings. Die eerste fokusarea van die empiriese navorsing is die identifikasie van die verskillende soorte KMMO's wat in die industriële komplekse vir die studie gekies is. Vir hierdie doeleindes is 'n stel vrae ontwerp om inligting te bekom oor die kritiese kenmerke van KMMO's soos deur die DHN-klassifikasie bepaal word. Die opname het voorts gefokus om die tegnologiebestuursmodaliteite te belig sowel as hoe dit herlei kan word na die regeringsgeleide KMMO-tegnologie intervensies. Soos deur die probleemstelling uiteengesit, sluit die studie af deur die tegnologie-ontwikkeling binne die KMMO-sektor te ondersoek.

Die navorsingsprojek word afgerond deur die sleutelbevindinge voortspruitend uit die literatuurstudie en die empiriese navorsing te bespreek. Die literatuurstudie sowel as die empiriese navorsing kom tot dieselfde slotsom oor die swakhede in KMMO-tegnologie-ondersteuning en tegnologie-ontwikkeling. Vanuit die literatuurstudie en die empiriese navorsingsresultate kan die volgende gevolgtrekkings gemaak word:

- Die huidige regeringsintervensies vir KMMO-tegnologie is nie genoegsaam nie en spreek nie die tegnologiebehoefte van KMMO's aan nie; en
- Daar is onvoldoende of 'n gebrek aan tegnologie-ontwikkeling in die KMMO-sektor.

Beperkinge van die huidige intervensies rakende tegnologie-ontwikkeling is geïdentifiseer sowel as 'n aanbeveling oor 'n stel intervensies wat aangewend kan word om die negatiewe prentjie om te keer. Verdere navorsingsareas is voorgestel na aanleiding van hierdie bepaalde studie.

Lys van sleutelbegrippe: KMMO's, tegnologie-ontwikkeling, tegnologie-intervensies, regeringsinisiatiewe, werkloosheid.

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LIST OF ABBREVIATIONS

ARC	Agricultural Research Council
CPPP	Community Public Private Partnership
CSIR	Council for Scientific and Industrial Research
DST	Department of Science and Technology
DTI	Department of Trade and Industry
GDP	Gross Domestic Product
GEAR	Growth, Employment and Reconstruction Strategy
GEDA	Gauteng Economic Development Agency
HEI	Higher Education Institutions
IF	Innovation Fund
IP	Intellectual Property
IPR	Intellectual Property Rights
LED	Local Economic Development
MEP	Manufacturing Extension Partnerships
MRC	Medical Research Council
NACI	National Advisory Council on Innovation
NAMAC	National Manufacturing Advisory Council
NGO's	Non Governmental Organisations
NRF	National Research Foundation
OECD	Organisation for Economic Co-Operation and Development
R&D	Research and Development
SEDA	Small Enterprise Development Agency
SIM	Strategic Issue Management System
SMME	Small, Medium and Micro Enterprises
TEI's	Tertiary Education Institutions
TI	Technology Intelligence
TTI	Technology Transfer Infrastructure
VAT	Value Added Tax

DEFINITIONS

As far as this research project is concerned, the following definitions apply:

1. BASIC RESEARCH:

This refers to activities involved in generating new knowledge about physics, biological, and social phenomena.

2. APPLIED SCIENTIFIC RESEARCH:

This refers to research that is applied in solving a particular technical problem.

3. INVENTION:

Invention can be defined as the creation of a new idea which would lead to novel or new product(s), processes and or service.

4. INNOVATION:

Innovation can be defined as the introduction of new products, processes or service into the marketplace.

5. MANAGEMENT OF TECHNOLOGY:

Management of technology links engineering science and the management discipline to plan, develop and implement technological capabilities to shape and accomplish the strategic and operational objectives of an organisation

6. TECHNOLOGY:

Technology, a consequence of science and engineering is a broad concept that deals with knowledge, tools and crafts, and how this affects our ability to control and adapt our environment. The term can either be applied generally or to specific areas; examples include "construction technology", "medical technology", and or "state-of-the-art technology".

7. TECHNOLOGY COLONY:

Even though many countries of the world have gained political independence after World War II they essentially remained technologically dependent on their colonizers to supply technologies. Thus the term "Technology colony" is phrase used to describe the technology dependency relationship that developing countries have with developed due to a previous colonial relationship. This technology dependency has an effect of thwarting the economic development of such developing countries.

8. TECHNOLOGY TRANSFER:

Technology transfer is the process of sharing of skills, knowledge, technologies, methods of manufacturing, samples of manufacturing and facilities among industries, universities, governments and other institutions to ensure that scientific and technological developments are accessible to a wider range of users who can then further develop and exploit the technology into new products, processes, applications, materials or services.

9. SMALL AND MEDIUM ENTERPRISES:

Small and medium enterprises (also referred to as SMEs), small and medium businesses (also referred to as SMBs), and variations thereof are companies whose

headcount and or turnover falls below certain limits. The abbreviation SME occurs commonly in the European Union (EU) and in international organisations, such as the World Bank, the United Nations and the World Trade Organisation. In South Africa the term SMME, for Small, Medium and Micro Enterprises, is used. Elsewhere in Africa, MSME is used, for Micro, Small and Medium Enterprises.

CHAPTER 1

NATURE AND SCOPE OF STUDY

1.1 INTRODUCTION

Reducing unemployment has been identified as one of the key objectives of the South African government, and small and medium enterprises (SMMEs) have been identified as one of the possible solutions to address the South African unemployment challenge (SA, 2005:7-12). Technology, on the other hand, has been identified as one of the key drivers for SMME sustainability (SA, 2002:5-9). Through this, it is argued that:

- Technological advancements if well understood and captured, can be harnessed to ensure long-term sustainability of a business, or
- If not well understood and anticipated, technological advancements can also have a disastrous impact on business.

Understanding the role of technology and technology transfer thus becomes one of the elements that are crucial in understanding the overall sustainability of SMMEs.

One of the mechanisms that government can use in effecting its objectives of supporting SMMEs is through focused policy interventions. In South Africa, several policy initiatives have thus been done in:

- SMME development; as well as
- Technology development.

This mini-dissertation specifically focuses on the analysis of the government-led technology support services for SMMEs, in particular the identification of weaknesses and or barriers in the current technology transfer models that are being used. This study attempts to evaluate the effectiveness of these technology transfer interventions with the main aim being the identification of key drivers for successful technology transfer.

1.2 CAUSAL FACTORS TO THIS STUDY

It is a well established fact that given the right support SMMEs can play an important role in an economy (Berry, 2000:2-3). SMMEs can thus play a pivotal role in:

- Reducing unemployment;
- Promoting economic growth by manufacturing goods of value, and providing services;
- Contributing to a country's Gross Domestic Production (GDP);
- Contributing to the overall export performance of a country; and
- Supporting the country's global competitiveness.

One of the benefits of SMMEs from an economic perspective is that SMMEs as enterprises are not just suppliers of products and or services, but they are also consumers in their own right. Thus, it is important to note that SMMEs also play another important role, because of their purchasing power and demand for industrial or consumer goods. SMMEs can thus stimulate the activity of their suppliers just as their own activity is equally stimulated by the demand of their clients (Berry, Blottnitz, Cassim, Kesper, Rajaratnam & Ernst van Sevenster, 2002:4-5).

As indicated above, the role of SMMEs in the economy is quite significant. In Africa, 61% of the labour force outside the agricultural sector is employed in micro-enterprises, 21% in the modern economy sector, which includes private enterprises and the public sector, with the remaining 18% being unemployed (Adigum & Emuoyibofurhe, 2006:12-14). On the other hand, in the Organisation for Economic Co-operation and Development (OECD) countries, SMMEs comprise the majority of firms, and 65% of the total employment. In low-income countries with per-capita income between U\$100 and U\$500, SMMEs account for over 60% of GDP and 70% of total employment (Organisation for Economic Co-operation and Development, 2005:3-7).

Noting this, and from a South African context, SMMEs do thus have at least in theory the potential to address the unemployment challenge. It is against this background that

the South African government initiated several SMME related policy changes. The first significant policy change regarding SMMEs was the Growth, Employment and Reconstruction Strategy (GEAR). Through GEAR the South African government identified the SMME sector as an opportunity for addressing several challenges facing the South African economy (Berry et al., 2002:34).

This policy was a forerunner to a more specific framework for SMMEs – the White Paper on Small Business of 1995. The White Paper contained South Africa's first SMME policy framework which sought not only to identify SMMEs' challenges, but to also introduce a range of sustainable solutions for the South African SMME sector. The White Paper together with the National Small Business Act, Act 102 of 1996, paved the way for a range of new SMME support institutions and initiatives (Berry et al., 2002:34).

The need for development of SMMEs was also further recognised by the National Integrated Strategy of Entrepreneurship and Small Enterprises which, similar to the White Paper on Small Business also argues that SMMEs are one of the key opportunities for South Africa to adequately address the challenges of unemployment (SA, 2005:9).

From a different perspective, the National Research and Development Strategy raises a concern that the South African local manufacturing firms spend little resources on technological innovation. The National Research and Development Strategy further argue that SMMEs could potentially be one of the conduits through which this lack of technological innovation could be addressed (SA, 2002:5).

With these policy initiatives already under way, this study aims to disentangle some of the reasons for the modest SMME growth, and why SMMEs have not made a more significant contribution to employment and the overall economic growth of South Africa. By so doing, the study aims to identify weaknesses in the current government technology transfer initiatives which are an integral part of the South Africa industrial development policy (October, 2006:12).

The study thus investigates:

- the effectiveness of the government-led SMME technology support programmes, and
- whether SMMEs' needs are being met through these programmes.

1.3 PROBLEM STATEMENT

Although little research has been undertaken to specifically assess the effectiveness of new and restructured institutions providing support to South Africa's SMMEs, early indications are that the originally well intended policy measures suffer from sub-optimal implementation. General distrust to external agencies among SMMEs on the one hand and the incapacity of support institutions to persuasively raise awareness about their existence and effectiveness on the other hand, are said to lie at the heart of the problem (Berry, 2002:4-5). It is argued that there is poor co-ordination of service providers resulting in a replication of services, clustering of institutions in urban areas and provision of inappropriate SMME support services (Berry et al., 2002:14). Several shortcomings can thus be identified in the current government approach on SMME technology support programs from both:

- The intended beneficiaries of the technology support intervention, which are the SMMEs; and
- The provider of the technology support services, which is the government.

1.4 OBJECTIVES OF THE STUDY

This study thus sets forth as its key objectives, the examination of the extent of these highlighted problems as well as to, where applicable, find potential solutions. The **primary objective** is on how to meet SMME technology needs, whilst the **secondary objectives** are aimed at understanding the challenges facing the various government-led technology transfer and support programmes.

These objectives may thus be stated as follows:

1. To determine whether the SMME technology needs are being met by the current government-led technology support and transfer programmes;
2. To determine which services of the current technology support programmes are most frequently used, and to which do SMMEs attach most value;
3. To determine whether the current SMME technology support programmes enhance technology development and research within the SMMEs; and
4. Considering the intent of government policies with regard to supporting SMMEs, to suggest practical interventions from government to change and enhance current technology support programmes to address SMME technology needs.

1.4.1 Primary objective: the SMME technology problem

Access to appropriate technology support and transfer services as a tool for survival and competitiveness remain a difficulty for SMMEs, particularly newly established SMMEs. The South African National Research and Development Strategy notes and acknowledges this (SA, 2002:5). One of the arguments advanced in explaining this dilemma is that the previous South African government policy on science and technology was primarily driven by the survival imperatives during the sanctions and international isolation era of South Africa. During this phase, key strategic interventions were required by the State; for example, energy security, food security as well as defence. This meant

that the former South African National Research and Development Strategy favoured large public organisations at the expense of SMMEs. As a consequence, technology innovation efforts were only limited to large public institutions (SA, 2002:19-20).

1.4.2 Secondary objective: the government technology problem

As previously indicated, technology access and technology support mechanisms for SMMEs can play a crucial role in the overall survival and competitiveness of SMMEs. The lack of uptake of the technology opportunities has been attributed to a poor understanding of the role of technologies within the overall development and growth of a business (SA, 2002:5).

It is thus of particular concern that limited technology research and development occurs in the current South African economy, specifically the SMME sector. The concern is that there is poor exploitation of technologies to introduce novel and or technology-intensive products in the market. It is an acknowledged fact that, given the right support and ideal circumstances, SMMEs can, in fact, be a fertile ground for cutting-edge technology research and development (SA, 2002:9).

1.5 RESEARCH METHODOLOGY

1.5.1 Literature study

The literature study examines, relative to the primary and secondary objectives, how these objectives were addressed in other countries, if at all. The literature study as well as the empirical research also attempts to probe contributing factors towards success and failure.

1.5.2 Empirical research

Primary data for the research were captured manually into the Microsoft Office Excel software program, which was also used for data analysis.

The study employed a combination of a literature study and empirical research as a basis for the overall research. The empirical research was based on data sourced through questionnaires consisting of twenty questions which were concentrated on SMMEs' input areas such as:

- The classification of SMMEs according to the DTI SMME classification;
- Determining the quality and completeness of the technology service they receive from the technology support programmes;
- Determining which aspect of the support program they attach most value to;
- Determining the general approach used by SMMEs in adopting technologies; and
- Determining if SMMEs do consider technology management as part of their business management process.

The questionnaire was then distributed across four industrial parks in Pretoria metropolitan area, Pretoria is located in the northern part of Gauteng Province, South Africa, and administered to a total sample of seventy(70) SMME's or respondents.

The respondents were distributed across four industrial parks, namely:

- The CSIR Industrial Park in Lynwood east of Pretoria;
- The Innovation Hub in Lynwood east of Pretoria;
- Watloo Industrial park in Watloo central of Pretoria; and
- Ga-Rankuwa Light industrial park which is northwest of Pretoria

These centres were selected for investigation and each had an average of approximately eighteen SMME's participating per industrial park. Each SMME was

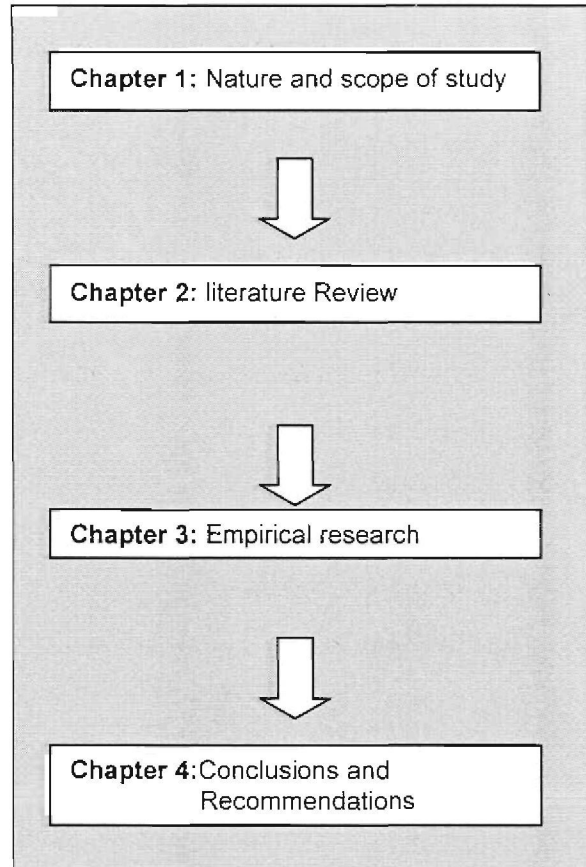
approached at its respective premise where the interview was conducted in English through reading the questions and filling the answers on behalf of the respondents. This was done to reduce the possible inconvenience that may have been associated with the process, however this also allowed the process to be relatively quick thus reducing the burden on the part of the participating SMME's, whilst at the same time eliminating the risk of misunderstanding the question.

1.6 RESEARCH LIMITATIONS

Even though a reasonable sample of SMMEs was interviewed as part of the empirical research, it must, however, be acknowledged that information on technologies and or technology management is in some instances integral to business as well as products of the SMMEs' based companies, which made this type of information potentially confidential. Thus there may have been an element of non-disclosure and or limited disclosure, based on the trust relationship that could be struck with respondents within the limited interviewing time. Notwithstanding this, every effort was taken to ensure accuracy of the data sourced through the process. The boundary of the study was also limited to data sources and literature available in South Africa.

1.7 LAYOUT OF THE STUDY

FIGURE 1.1: LAYOUT OF THE STUDY



The layout of the study is shown in the **Figure1.1** above.

1.8 CONCLUSION

The chapter identifies and describes one of the biggest economic challenges facing the post 1994 government of South Africa – unemployment – and considers one of the alternative solutions put forth to address this challenge, which is to use the SMME sector for job creation. This chapter raises another concern: that SMMEs have in the past not performed well in job creation due to developmental challenges they so frequently face, one of which is a lack of access to appropriate technologies. The project thus sets forth, as its primary objective, to investigate the poor performance in the government-led technology support services, which were established to address this challenge. The secondary objective of the study is the investigation into the lack of technology development in the SMME sector, informed by the concern raised in the R&D strategy of South Africa, which argues that there is a decline in R&D spent by South African companies, leading to South Africa being a net importer of technologies. The research process is described, which includes the sample selection process, literature review, empirical research, analysis and conclusion.

1.9 SUMMARY

The chapter starts off with a review of the South African unemployment challenge as well as the various options considered to address unemployment, one of which is the utilization of the SMME sector. A detailed description of the government approach in using SMMEs as a vehicle for addressing unemployment is provided. The lead department, the DTI, responsible for driving the SMME sector is discussed as well as the supporting technology role of the DST. The chapter also reviews major SMME policy interventions emanating from both the DTI and DST, particularly after 1994. The broader role of SMMEs in an economy is also discussed, which also provides a perspective from a developing country context.

In summary, the chapter provides:

- a description of the various roles SMMEs can play in an economy;
- an overview of key SMME policy interventions post 1994;

- the problem statement; and
- a discussion of the research objectives, with reference to the primary objectives as well as the secondary objectives.

In addition to the above, the chapter also includes an overview of the research method followed, the process followed in acquiring data, and boundaries and limitations of the study. Further to this, a brief overview of the subsequent chapters of the mini dissertation is also provided.

CHAPTER 2

LITERATURE REVIEW

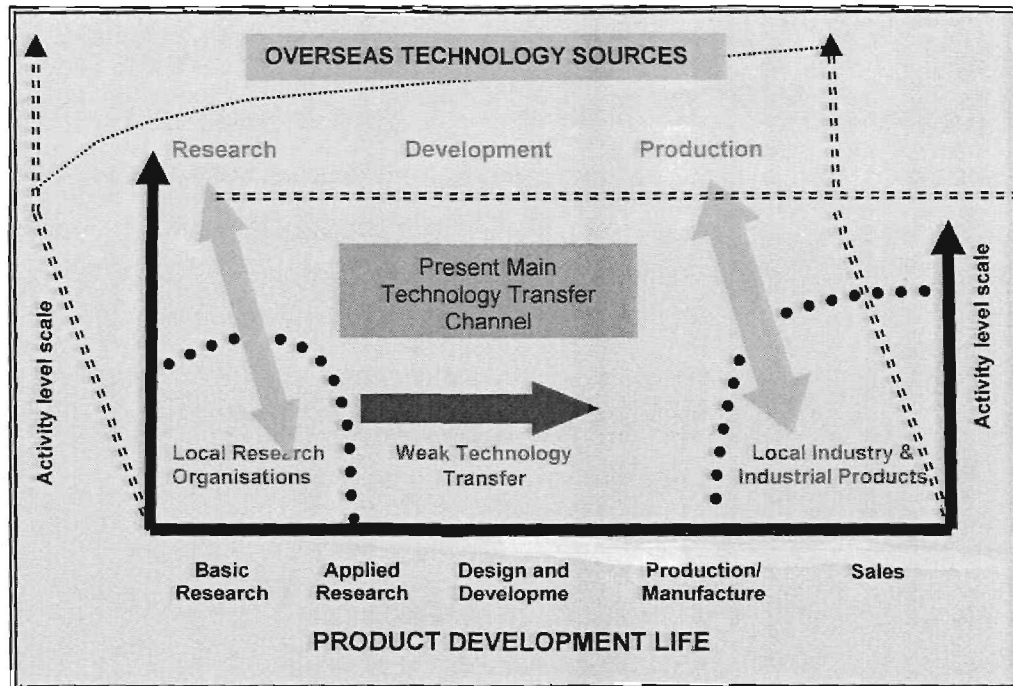
2.1 INTRODUCTION

The chapter provides an overview of the technology challenges faced by South Africa; the overview specifically focuses on technology role players and how they relate to each other. The chapter further provides a perspective of technology development and transfer challenges in the SMME sector. A limited overview of various SMME technology developments and transfer interventions employed internationally is also provided. Since, in South Africa, SMME support is a mandate that cuts across all three spheres of government (national, provincial and local), an overview of the current South African government SMME interventions is also provided.

2.2 THE SOUTH AFRICAN TECHNOLOGY CHALLENGE

According to the literature, in South Africa, more than 80% of the value of industrial business activity is done under foreign licence. More than 50% of this activity is subject to market constraints, creating what can be coined a **"Technology Colony"** also known as an **"Innovation Chasm"** (Coetzee & Phohole, 2006:106). This notion of an **"Innovation Chasm"** or a **"Technology Colony"** is explained by Coetzee and Phohole (2006:106) in the three-dimensional **Figure 2.1** below, where the levels of research are plotted against the product life cycle. According to the **Figure 2.1** below, very little knowledge generation is done locally in the colony, and technology is imported from abroad with the use of local skills only limited to maintaining these imported foreign technologies.

FIGURE 2.1: TECHNOLOGY COLONY



Source: (Coetzee & Phohole, 2006:106)

These challenges of the technology colony can be described as the follows:

- R&D activities in South Africa are only at the manufacturing end of the product life cycle, whilst activities in the industrialized countries tend to have R&D activities that cover the whole product life cycle; that is, from concept development to final production.
- A relatively limited group of activities exist at the local research end, representing the R&D, which is informed by overseas challenges instead of local industry imperatives.
- There is a large inflow of technology from industrialized countries into South Africa in the form of licensed product designs, processes, sub-assemblies and final products.
- There is insignificant inter-flow of technology between the local R&D community and the local industrial sector.

- There is a limited influence of the local research agenda by the R&D needs of the local industries.
- There is instead, some communication between local and foreign R&D communities.
- The local R&D skills base is developed around maintaining imported technologies instead of focusing on the R&D of new technologies addressing local challenges.

The literature review further indicates that there are various strategies that could allow South Africa to evolve from the technology colony; these include, focusing on strengthening the domestic Intellectual Property Rights (IPR) regime, and enhancing the design houses for domestic products or processes (SA, 2002:63). Another alternative for resolving the technology colony that Coetzee and Phohole (2006:106) argue for, is minerals beneficiation; considering that South Africa is a net exporter of raw mineral resources, there is an enormous value that could be added through minerals beneficiation (SA, 2002:37).

These minerals beneficiation opportunities are recognised in the National R&D strategy of South Africa; the R&D strategy further recognises the SMME sector as an opportunity that could also not only reverse the negative technology development trend but also address the unemployment challenge facing South Africa. Notwithstanding this, the R&D strategy specifically recognises the technology challenges facing the SMME sector and further alludes to some of the technology transfer interventions currently being implemented to address these challenges (SA, 2002:63).

2.3 SMME TECHNOLOGY CHALLENGES

Technology challenges facing SMMEs can predominantly be attributed to difficulties associated with the continuously changing technological landscape and its impact on the

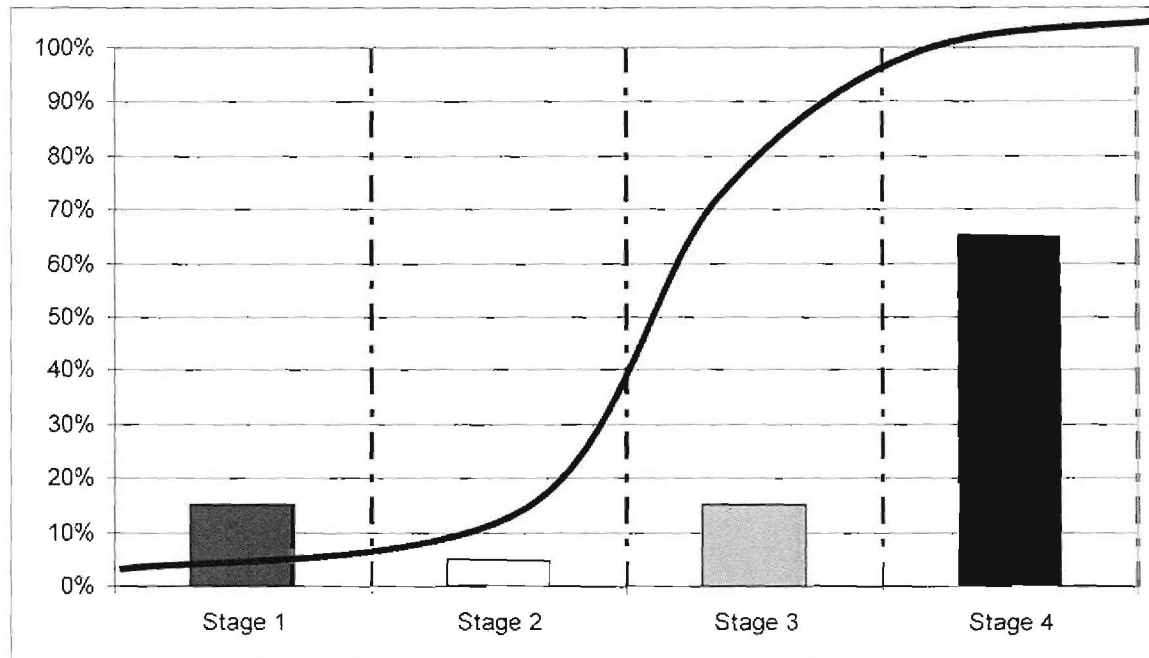
SMME's business environment (Oerlemans & Pretorius, 2006:590-591). These technology challenges include:

- increasing complexity of technologies;
- convergence of technologies;
- abundance of technological options;
- higher cost of technological development; and
- the rapid pace of diffusion of technologies.

In addition to this, the dispersion of technology sources across organisations and geographical locations makes the task of accessing suitable technologies and selection of the most suitable technologies a complex one. One of the challenges that SMMEs face is access to tools, for identifying not only the appropriate technologies but tools to successfully operationalise such technologies. The abundance of technological options, organisational complexities of the receiving company, and dynamism of the business environment necessitates a need for methods that guide the selection of these technologies. This challenge has led to a rather limited diffusion and use of technologies by the SMME sector, which, in turn, has limited the exploitation of technologies by SMMEs (Oerlemans, Rooks & Pretorius, 2005:40-46).

The technology diffusion alluded to above, can be defined as the process by which existing or new technologies are introduced to potential user organisations (Coetzee & Phohole, 2006:103). **Figure 2.2** below provides a framework for illustrating technology diffusion challenges facing SMMEs based on an S-curve, where the "bars" illustrate the participation of SMMEs in the various phases of the technology diffusion S-curve, measured as a percentage of the SMME's involvement. **Figure 2.2** demonstrates that with the exception of Stage 1 of the technology S- curve, there is limited SMME participation in each of the subsequent stages of the diffusion process (Coetzee & Phohole, 2006:103).

**FIGURE 2.2: SMME INVOLVEMENT IN THE TECHNOLOGY DIFFUSION
DEVELOPMENT PROCESS**



The "bars" illustrate the participation of SMMEs in the various phases of the technology diffusion (Coetzee & Phohole, 2006:103).

Figure 2.2 is explained below:

**Stage 1: Technology application development and trial
implementation:**

- In this stage, SMMEs are the initial developers of new and advanced technologies.
- Technology trials within smaller companies are easier to implement thus enhancing potential SMME involvement during this phase.

Stage 2: Early adoption of the technology for commercial applications:

- Large manufacturers are seen as industry leaders and have an influence on future technology adoption trends more than the SMMEs.
- SMMEs are usually not interested in being early adopters, as they are more concerned with "downside" risk of adoption due to their limited access to capital.
- SMMEs are typically not targeted by technology developers for early adoption of such technologies.
- SMMEs also lack internal expertise to evaluate and successfully implement new technologies; and
- SMMEs' lack of ability to fully evaluate these new technologies tends to lead them to underestimating the potential economic and competitive benefits of these new and "advanced" technologies.

Stage 3: Rapid commercialisation of the technology and market penetration

- SMMEs' adoption of new technologies is greater in this stage relative to stage 2; however, the extent of participation remains relatively low due to SMMEs' lack of expertise to evaluate new and advanced technologies.
- The underestimation of benefits, and risk aversion by SMMEs contribute to slower adoption of new technologies.

Stage 4: Late adopters acquire the technology as it saturates the market

- The technology's competitive advantage is well

known: "late adopters" acquire the technology in order to remain competitive.

- At this stage, advantages of the new technologies could have been seized competitors.

The over-concentration of SMMEs only in the early stages of technology development processes suggest that SMMEs lack the ability to strategically position themselves in the various stages of technology development and adoption process, as demonstrated in the technology S-curve indicated in **Figure 2.1** above (Kahn & Hounwanou, 2008:517-520).

The lack of strategic positioning on the technology S-curve points to SMMEs' challenges in technology management partly attributed to a lack of technology management tools. This technology management processes include the evaluation, selection and the ultimate adoption and use of these technologies by SMMEs. Through tools, such as technology selection framework, SMMEs can identify, evaluate and ultimately select appropriate technologies. The technology selection framework as a tool represents the issues surrounding the selection of a technology, and thereby supporting practical processes that can be followed in its selection (Shehabudeen, Phaal & Probert, 2006:326).

2.4 TECHNOLOGY MANAGEMENT TOOLS FOR SMMEs

As mentioned above, SMMEs are exposed to an environment of constant technological change (Tushman & Moore, 1988:249). The awareness of and the will to take advantage of these technological changes are crucial for the survival of SMMEs. Technology intelligence (TI) is one of the methods and systems that companies, including SMMEs, can use to keep track of the latest technological developments. There are four basic TI forecasting methods which are normally used: extrapolation, leading indicators, causal models and probabilistic methods (Tushman & Moore, 1988:249).

The underlying concepts for the abovementioned methods can be further separated into the following underlying technology intelligence approaches (Blum & Savioz, 2002:91):

- **Issue management approach:** Issue management approach tries to identify future trends in time to prevent a crisis (Blum & Savioz, 2002:92).
- **Knowledge management approach:** The knowledge management approach can be described as the task of developing and exploiting an organisation's tangible and intangible knowledge to create a potential for an organisation's competitive advantage (Blum & Savioz, 2002:93).
- **Gatekeeper management approach:** This method of technology intelligence requires an enterprise to identify a person who is frequently in contact with stakeholders outside their organisation and regularly engages these stakeholders on various aspects of the business (Blum & Savioz, 2002:93).
- **Balanced scorecard approach:** The balanced score card is a tool that merges the company's financial and non-financial measurements into one single comprehensive view of the company's performance, relative to its business strategy (Niven, 2005:116).

With such tools, SMMEs are in a better position to exploit and benefit from most technological changes that would otherwise have a disastrous effect on a business (Rogerson, 1998:893). There is an ever-growing knowledge of various technology management instruments that SMMEs can use to address their technological challenges. It is, however, acknowledged that such instruments are best provided by government.

2.5 INTERNATIONAL PERSPECTIVE ON SMME TECHNOLOGY SUPPORT INTERVENTIONS

Considering the point raised above regarding the role of government in technology diffusion, it has been established internationally that technology diffusion is most successful if an external stimuli is provided by national governments (Jeppesen, 2005:471-472). A common feature of technology programmes in other countries is government's investment in assistance programmes for SMMEs in the form of grants, subsidies or other incentives. These technology programmes are supported by dedicated technology diffusion agencies to help deliver these programmes; examples of these agencies and their respective countries are provided in the **Table 2.1** below (Coetzee & Phohole, 2006:105):

TABLE 2.1: TECHNOLOGY TRANSFER AGENCIES AND COUNTRIES OF ORIGIN

TECHNOLOGY TRANSFER CENTRE(S)	COUNTRY OF ORIGIN
Fraunhofer Institutes and Steinbeis Foundations	Germany
Danish Technology Institute	Denmark
Kohsetsushi and Technopoljs	Japan
TNO (Netherlands Organisation for Applied Research)	Netherlands
ERVET(<i>Italian: Emilia-Romagna Exploitation Accommodation Territory</i>) Centres	Italy
TEC (Technology Evaluation Centre)	United Kingdom
TEC (Technology Evaluation Centre)	United States of America

Source: Coetzee and Phohole (2006:105).

For these various technology diffusion programmes to take place, they require a technology source as well as a recipient of the technology, in this case an SMME. According to Coetzee and Phohole (2006:105), there are four ways of linking technology sources and the recipient through the technology transfer infrastructure. These source-recipient options are provided in **Table 2.2** below:

TABLE 2.2: TYPES OF TECHNOLOGY TRANSFER INFRASTRUCTURES

TYPE	FUNCTIONS AND CHARACTERISTICS	EVALUATIONS	EXAMPLES
Multi-linked Technology Transfer Institution (TTI)	Majority of these technology sources are universities and research laboratories where the TTIs are relatively independent	A variety of technologies are easy to access, but it takes time and an extensive investment is required to establish an integrated transfer system.	Innovation Centres, the Netherlands
Manufacturing Extension Partnership TTIs	These types of TTIs are more programme oriented than physical institutions established in order to promote the diffusion of new technologies to industry	Cost less than other types of transfer, because this type is more programme oriented; however, technology transfer is limited to agencies within partnership	Manufacturing Extension Partnership, US, Kohsefsushi Centres, Japan
TTIs in the industrial districts	TTIs are located within industrial districts; transfer of technology is directly linked to products without much elaboration.	Transfer cost is very low; however, technologies which have no immediate prospect of commercialisation would not be transferred	ERVEL Emilia-Romagna, Italy. IMPIVE. Valencia, Spain.
TTIs closely linked to the Higher Education Institution (HEI)	TTIs are closely linked to HEIs in terms of location, network, or linkage.	Basic or standard technology is easily transferred.	Steinbeis Foundation. Baden-Württemberg, Germany

(Source: Coetzee & Phohole, 2006:105)

Such institutions have been established to address SMME market failure in these respective countries. Whilst these institutions are recognised as necessary for industry development, they all require some degree of government incentive to continue their work in overcoming SMMEs' barriers for adopting new technologies (Rogerson, 1998:879).

2.6 THE SOUTH AFRICAN PERSPECTIVE ON SMME TECHNOLOGY SUPPORT

At the national level, SMME support, in particular technology support is a mandate that straddles two national departments. These are the DTI and the DST. Interventions in both instances are brought through policies which are implemented through dedicated programmes and institutions, as described below.

2.6.1 Department of Trade and Industry

The Department of Trade and Industry can be regarded as the main or lead department on matters relating to South Africa's industrial development. One area of focus for the DTI is the SMME sector.

2.6.1.1 SMME policy framework

SMME support from the DTI is guided by the Integrated Strategy on the promotion of Entrepreneurship and Small Enterprises (SA, 2005:2-3). This DTI strategy is based on three strategic pillars, which are:

- **Strategic pillar 1:** focusing on increasing the supply for financial and non-financial support services;
- **Strategic pillar 2:** creating the demand for small enterprises' products and services; as well as
- **Strategic pillar 3:** reducing SMME regulatory constraints.

The focus of the strategy is that of support for designated target groups and priority developmental geographical areas. In summary, the strategy attempts to strengthen support for SMMEs' access to finance, create an enabling regulatory environment, expand market opportunities, localise small business support, drive the national entrepreneurship education, and fund minimum business infrastructure facilities in local authority areas across the country (SA, 2005:2-3).

2.6.1.2 Department of Trade and Industry SMME support

In terms of the implementation of the abovementioned strategy, the main agency driving the implementation is the Small Enterprise Development Agency (SEDA). SEDA is an agency of the DTI that was established in December 2004 in terms of the National Small Business Amendment Act, Act 102 of 1996. The mandate of SEDA is to design and implement a standard national SMME support service delivery network that must be uniformly applied throughout the country. SEDA's role includes the support and promotion of co-operative enterprises, particularly those located in rural areas.

As indicated above, the work of SEDA originates from within the DTI's Integrated Small Enterprise Development Strategy, and according to this strategy SEDA's delivery network must reach all regions of the country and integrate government-funded small enterprise support across all three spheres of government. In terms of infrastructure facilities, the strategy proposes an integrated approach which will link up closely with current local economic development efforts in local authorities.

2.6.2 Department of Science and Technology SMME support

The DST is another national department tasked with the responsibility of supporting SMMEs, particularly technology support. The key policy intervention from the DST in this regard is the National Research and Development Strategy (SA, 2002:63).

2.6.2.1 National science policy: National Research and Development Strategy

The Department of Science and Technology has introduced the National Research and Development Strategy to primarily align research initiatives in the country. The National Research and Development Strategy was introduced to address the concern that South African local manufacturing firms spend little on innovation. This view is based on an observation that there has been a gradual decline in the national research and development spend from 1.1% in 1990 to 0.7% of GDP in 1994 (SA, 2002:37).

Whilst the DTI's Integrated Strategy on the Promotion of Entrepreneurship and Small enterprises approach on SMMEs is a phased one, based on the stage of development of an SMME, the National Research and Development Strategy on the other hand considers the distinctions between the stages of research to be artificial, and recognizes the critical factor to be rather the ultimate commercialisation of technologies. This strategy argues that the economic benefits and social development accrue only when a technology is brought to the marketplace where it can generate income and increase productivity. The strategy further makes a point that most innovations do not solely depend on basic or applied research, but rather often occur due to incremental improvements of existing products and or processes. Technological developments often involve risks; the National Research and Development Strategy recognises this and seeks to minimize these undesirable uncertainties through government's programmes and policies (SA, 2002:37).

In addition to the R&D strategy above, the DST's National Advisory Council for Innovation (NACI) established through the NACI Act, Act 55 of 1997, has also initiated the development of the complementary Advanced Manufacturing Technology Strategy. This strategy also aims to induce higher levels of technology use in industry as well as increase the innovativeness of local firms (SA, 2002:5).

2.6.2.2 Department of Science and Technology programmes and institutional support

The objectives of the policy interventions are delivered through various instruments or interventions that are designed to address the identified SMME technological challenges.

- **Research and Development Tax Incentive Programme**

The purpose of the DST R&D Tax Incentive Programme is to encourage the private sector to invest in research and development activities. The R&D tax incentive is an indirect approach to encourage expenditure on R&D, and complements government's formal expenditure on R&D, which is done through innovation support institutions such as the:

- Council for Scientific and Industrial Research (CSIR);
- National Research Foundation (NRF);
- Agricultural Research Council (ARC);
- Mintek;
- Medical Research Council (MRC); and
- Universities.

These measures are part of the avenues used by the DST in increasing the national spend on R&D. It is thus the DST's intent to increase the national R&D spend to 1% of the GDP by the end of 2008 (SA, 2002:70).

- **National Research Foundation – Innovation Fund**

The Innovation Fund (IF) is an instrument of the DST set up to facilitate technology innovation. It is managed by the National Research Foundation (NRF), an institution of the DST, and funds near-market and end-stage research that has the potential to result in new intellectual property, commercial enterprises and the expansion of existing industrial sectors (SA, 2002:75).

2.6.3 GAUTENG PROVINCE SMME SUPPORT

Except for the Medical Research Centre (MRC) head office in Cape Town, all the abovementioned DST innovation support institutions have their head offices located in Gauteng province. Gauteng province also has the highest concentration of tertiary institutions. It is against this background that Gauteng province is regarded as important in the South African technology landscape. From an economic perspective, Gauteng province is also quite important; for example, it generates 10% of GDP for the African continent, and a third of South Africa's GDP. The main Gauteng government institution mandated with driving economic growth is the Gauteng Economic Development Agency – GEDA (Gauteng Provincial Government, 2008:2). GEDA has a broad mission which focuses on the promotion of economic growth and encouragement of new investments in Gauteng. One of GEDA's aims is to develop Gauteng as the most technologically advanced province in South Africa through:

- Creating a high value-added manufacturing sector; and
- Re-aligning manufacturing away from traditional heavy industry input markets and low value-added production towards sophisticated high value-added production through SMMEs.

Key technology platforms identified by GEDA in this regard are information and telecommunications technologies (ICT) and bio-medical industries. It is GEDA's belief that these technology platforms are key in ensuring the competitiveness of the Gauteng economy.

2.7 CONCLUSION

In conclusion, the chapter provides a perspective of the South African technology challenge "the innovation chasm", as well as alternatives that could be pursued by government in addressing these challenges. The chapter further discusses the

technology challenges faced by South Africa and how these technology limitations manifest themselves in the SMME sector, as reflected on the technology S-curve. A limited international overview of various SMME technology transfer programmes and institutions used is also provided. The chapter concludes by providing a detailed analysis of SMME support interventions across the various spheres of the South African government. Key line function departments are identified, and their respective policies, programmes and institutional support are discussed.

2.8 SUMMARY

The literature review considered literature sources available in South Africa from the research areas of focus as defined in the scope of the study. The first area of focus in the literature was a survey on technology development challenges as identified in the R&D strategy. The second area of focus in the literature survey was a review of the technology development challenges for the SMME sector. Instruments for technology development that SMMEs can use were also identified and discussed as part of the literature survey. The chapter concludes with an overview of the South African government SMME and technology interventions, which are complemented by an overview of international technology support interventions for SMMEs. Typical infrastructural arrangements of such international technology related interventions were also described.

CHAPTER 3

EMPIRICAL RESEARCH

3.1 INTRODUCTION

As previously indicated the empirical research was conducted at four industrial centres across the Pretoria Metropolitan area. The metropolitan area is inhabited by almost two million people and has on average the highest educational level in the country. Pretoria is a national centre of research and learning with four universities and the headquarters of both the Council for Scientific and Industrial Research and the Human Sciences Research Council. The centres selected not only provided the necessary geographical spread across the Pretoria Metropolitan area necessary for an accurate sampling process but also addressed the necessary representation of the economic and technological differences that are present in cities across South Africa.

The sampling process involved the random selection of a minimum number SMME's within the selected industrial centres, once the necessary approvals were secured from the business owners the data gathering processes commenced. Data and information for empirical research was gathered through questionnaires which were administered at the four industrial parks identified in the scope of the study. The data acquisition process was done over a period of three months and involved the following three data acquisition options:

- **Option 1:** SMMEs were independently requested to complete the questionnaire.
- **Option 2:** SMMEs completed the questionnaire with support from the researcher; in this case, support was limited to clarifying the questionnaire only.
- **Option 3:** This option entailed data acquired from the SMMEs through an interview session. This option was only used for SMME

subjects that were unable to complete the questionnaire on their own.

A general observation made, is that it proved quite useful to provide additional support to the SMMEs in answering the questionnaire as it provided immediate clarification on the questions in the event that there were uncertainties. Data acquired were then captured on a Microsoft Office Excel software spreadsheet; this software was also used for processing and analysing the data.

3.1.1 Questionnaire design and sampling procedure

In order to ease the administration of the questionnaire and avoid any discomfort or uncertainty relating to the survey, the SMMEs were also taken through an introductory discussion to clarify the intent of the study:

- an explanation of the purpose of the study;
- the institution supporting the study; and
- possible benefits of the study in terms of inputs to the SMME policy development process.

In addition to the discussion, there was also an undertaking made, assuring the SMMEs that the information gathered would only be used for the purpose described above.

3.1.2 Questionnaire and empirical data

The questionnaire was structured, firstly, to provide a basic analysis of SMMEs within the industrial complexes investigated as well as an analysis of a spectrum of SMME technology issues as identified in the scope of the study. The SMME sample for the study that was selected and that participated in the questionnaire was in total 70 (n=70).

3.2 CLASSIFICATION IN TERMS OF THE DTI CATEGORIES

According to Statistics South Africa (Lehola, 2002:12), there are more than 800 000 SMMEs in the country, which absorb about a quarter of the labour force of fifteen million people. This is in addition to about 3 500 000 people involved in some or other type of survivalist enterprise activities. The SMME sector is thus highly diverse, with structures, problems, growth potential and access to support differing widely between segments. These differences also relate as much to the SMME economic sectors such as retailing, manufacturing and mining as they relate to the stages of growth of enterprises, such as start-up, expanding or stagnating (Lehola, 2002:12).

From a broad perspective, the most important distinction is made up of two broad groupings; that is, between survivalist activities, micro-enterprises, small enterprises, medium-sized enterprises, or generally termed small business and bigger business. Whilst this diversity of the sector is acknowledged, there are some similarities that have also been identified. For example, due to the similarity of some of the obstacles facing them, survivalist and micro-enterprises are often lumped together. It is thus important that an attempt is made to clarify the various categories that represent the SMME sector. The following four categories can assist in delineating the various SMME segments as outlined by the Department of Trade and Industry (SA, 2005:30-32). These categories are:

- **Survivalist enterprises**

Survivalist activities are those undertaken by people unable to find a paid job or get into an economic sector of their choice. Income generated from these activities usually falls far short of even the minimum income standard, with little or no capital invested. In this category, there is virtually no skills training and these only have limited opportunities for growth into a viable business. Poverty and the attempt to survive are the main characteristics of this category of enterprises.

- **Micro-enterprises**

These are very small businesses, often involving only the owner, some family members and, at the most, one or two paid employees. They usually lack 'formality' in terms of business licences, value-added tax (VAT) registration, formal business premises, operating permits and accounting procedures. Most of these enterprises have a limited capital base and only rudimentary technical or business skills among their operators; however, many micro-enterprises advance from this into viable small businesses. Earning levels of micro-enterprises differ widely, depending on the particular sector, the growth phase of the business and access to relevant support.

- **Small enterprises**

This category constitutes the bulk of the established SMME businesses, with fulltime employees ranging between five and fifty. These enterprises will usually be owner-managed or directly controlled by the owner-community. They are likely to operate from business or industrial premises, be tax-registered and meet other formal registration requirements. Classification in terms of assets and turnover is difficult, given the wide differences in various business sectors like retailing, manufacturing, professional services and construction.

- **Medium enterprises**

This constitutes a category that is difficult to demarcate relative to the "small" and "big" business categories. This category is still viewed as basically owner or manager-controlled, though the shareholding or community control base could be more complex in some instances. These enterprises have up to two hundred fulltime employees and capital assets of up to R5 million.

While there is merit for the above classifications due to its practicality and simplicity in use, these classifications do have a limitation. The limitation emanates from the fact that SMMEs are not a homogenous group; in fact, SMMEs display significant variability if one

considers them from a sectoral perspective. This variability is recognised in the National Small Business Amendment Bill of 2003, which further breaks down the abovementioned categories in accordance with Standard Industrial Classification (SIC) categories (SA, 2003:5-6).

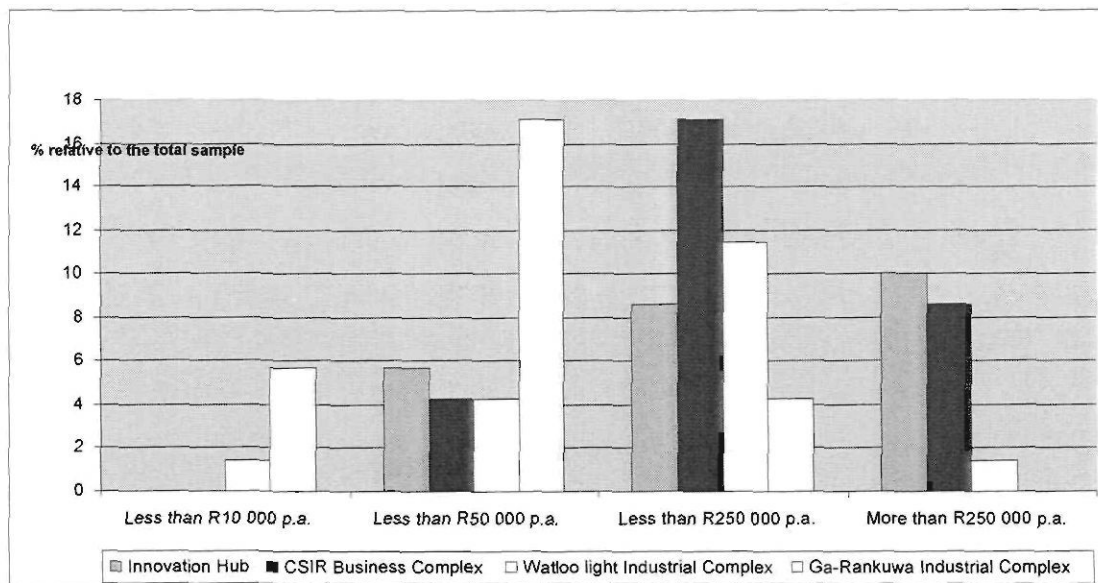
3.2.1 Classification in terms of income

This section of the questionnaire categorises SMMEs in terms of income as indicated in the DTI categories above. Income is but one of the several aspects that the DTI uses for the classification of SMMEs. The absolute data as recorded from **Table 3.1** are also graphically presented as percentages in **Figure 3.1**.

TABLE 3.1: CLASSIFICATION OF SMMEs ACCORDING TO INCOME (N=70)

	Less than R10 000 p.a.	Less than R50 000 p.a.	Less than R250 000 p.a.	More than R250 000 p.a.
Innovation Hub	0	4	6	7
CSIR Business Complex	0	3	12	6
Watloo Industrial Complex	1	3	8	1
Ga-Rankuwa light Industrial Complex	4	12	3	0

FIGURE 3.1: CLASSIFICATION OF SMMEs ACCORDING TO INCOME (N=70)



According to the data received, all the industrial parks are fairly well represented across the four income categories used; there is, however, a general observation and exceptions to this. These exceptions are:

- In the lower end of the income category, there were no recording of the CSIR Business Park SMMEs.
- At the high end of the income scale, there was also no recording of the Ga-Rankuwa Business Park SMMEs.

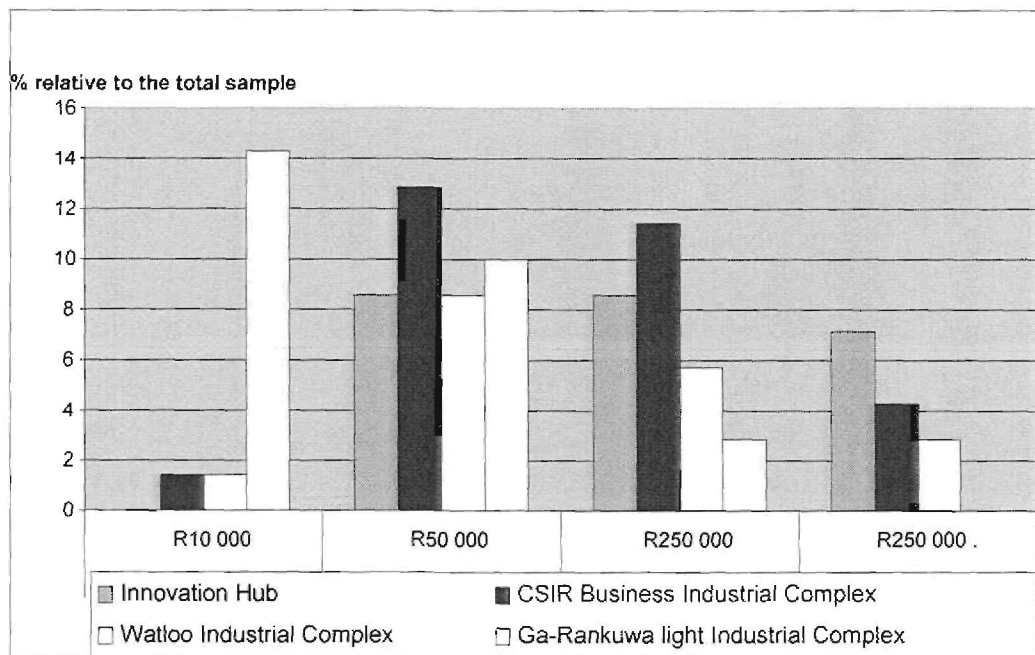
3.2.2 Classification in terms of capital invested

In addition to income generated, one of the financial measures used by the DTI in classifying SMMEs is the capital invested. Thus, the sample SMMEs was also classified in terms of the capital invested. **Table 3.2** is a record of the data collected, with **Figure 3.3** providing a percentage comparison of the data.

TABLE 3.2: CLASSIFICATION IN TERMS OF CAPITAL INVESTED (N=70)

	<i>Less than R10 000</i>	<i>Less than R50 000</i>	<i>Less than R250 000</i>	<i>More than R250 000</i>
Innovation Hub	0	6	6	5
CSIR Business Complex	1	9	8	3
Watloo Industrial Complex	1	6	4	2
Ga-Rankuwa light Industrial Complex	10	7	2	0

FIGURE 3.2: PERCENTAGE COMPARISON IN TERMS OF CAPITAL INVESTED (N=70)



Similar to the observations made above, there is a bell-shaped distribution of the SMMEs across the four industrial parks. This is, however, only true if one ignores the data associated with Ga-Rankuwa Industrial Park; in this case, the data follows a linear pattern showing a marked reduction in the capital invested.

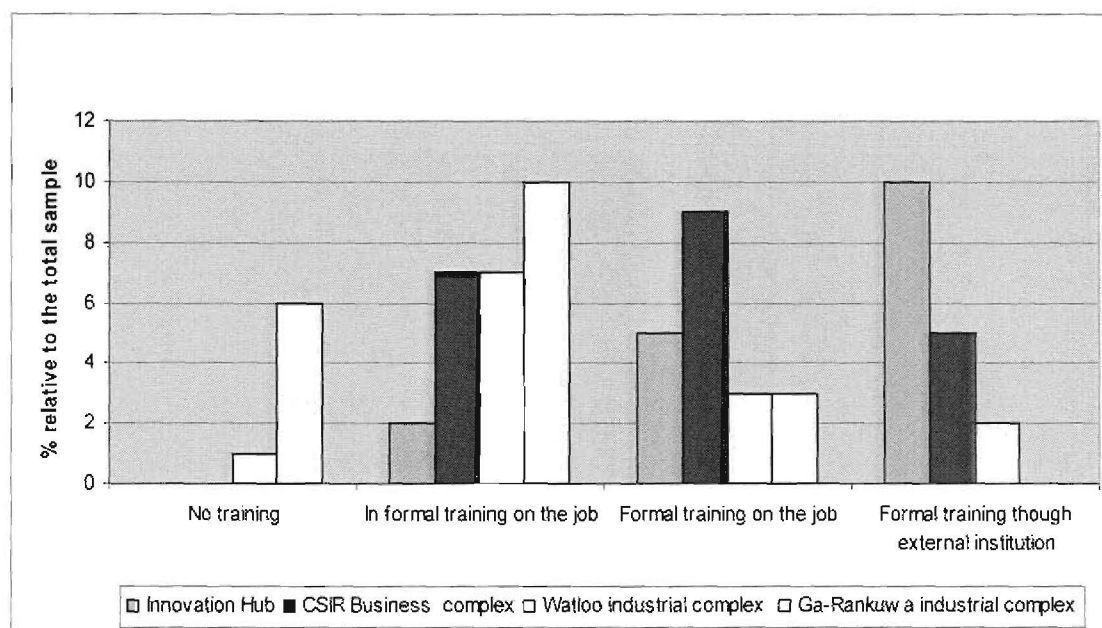
3.2.3 Classification in terms of training of personnel

Training is one of the key indicators of development of SMMEs. The survey also attempts to elucidate the status of training of the various SMMEs. **Table 3.3** is a recording of the data, whereas **Figure 3.3** provides a percentage comparison of the data received.

TABLE 3.3: CLASSIFICATION IN TERMS OF TRAINING OF PERSONNEL
(N=70)

	No training	In formal training on the job	Formal training on the job	Formal training though external institution
Innovation Hub	0	2	5	10
CSIR Business Complex	0	7	9	5
Watloo Industrial Complex	1	7	3	2
Ga-Rankuwa light Industrial Complex	6	10	3	0

FIGURE 3.3: CLASSIFICATION IN TERMS OF TRAINING OF PERSONNEL (N=70)



What is observed through the data gathered is that all four centres do have access to some form of training; however, the following key observations were made:

- There is a clear preference of training as an intervention; and
- There appears to also be a preference of the form of training given.

There is, however, an anomaly identified, in that the Watloo Industrial Park shows a marked preference towards formal and higher education training.

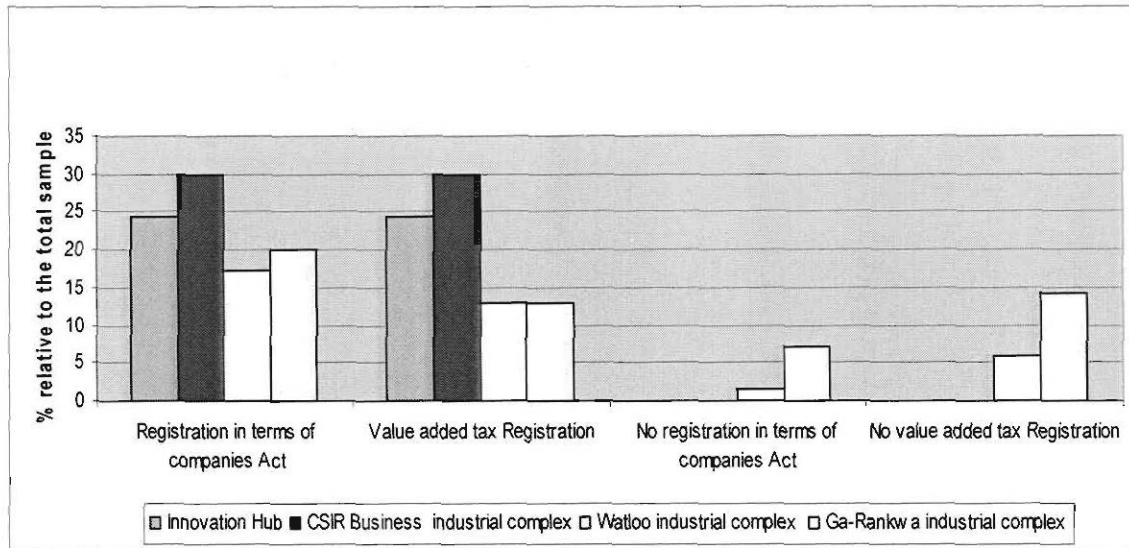
3.2.4 Registration in terms of the Companies Act and of value added tax (VAT)

It is a legal requirement in South Africa that companies are registered in terms of the Companies Act, and also have to pay tax. Tax registration of companies is thus a good indication of the level of development of SMMEs. The sample of SMMEs that participated in the survey was classified in terms of company registration and value added tax registration.

TABLE 3.4: REGISTRATION IN TERMS OF THE COMPANIES ACT AND OF VALUE ADDED TAX (VAT) (N=70)

	Registration in terms of Companies Act	Value added tax registration	No registration in terms of Companies Act	No value added tax registration
Innovation Hub	17	17	0	0
CSIR Business Industrial Complex	21	21	0	0
Watloo Industrial Complex	12	9	1	4
Ga-Rankwa light Industrial Complex	14	9	5	10

FIGURE 3.4: PERCENTAGE COMPARISON IN TERMS OF REGISTRATION OF THE COMPANIES ACT AND OF VALUE ADDED TAX (VAT) (N=70)



According to the data received, all centres indicated the awareness to legislation that governs the enterprises in South Africa. The CSIR Industrial Park and Innovation Hub showed 100% compliance to the selected legislation, while the other two centres showed poor compliance to the legislative requirements identified above.

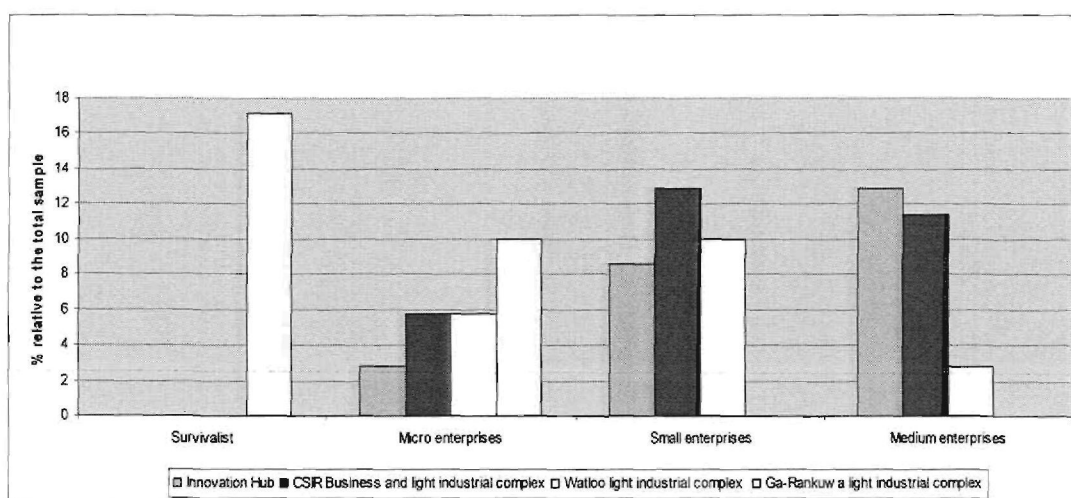
3.2.5 Classification in terms of number of employees

The number of employees of an organisation is also a good indicator of the extent of development of the SMME. The sample of SMMEs that participated in the study was also classified in terms of the people it employed.

TABLE 3.5: CLASSIFICATION IN TERMS OF NUMBER OF EMPLOYEES (N=70)

	Survivalist	Micro enterprises	Small enterprises	Medium enterprises
Innovation Hub	0	2	6	9
CSIR Business Industrial Complex	0	4	9	8
Watloo Industrial Complex	0	4	7	2
Ga-Rankuwa light Industrial Complex	12	5	4	0

FIGURE 3.5: PERCENTAGE COMPARISON OF THE SMMEs IN TERMS OF NUMBER OF EMPLOYEES (N=70)



The data indicates that on the basis of employee numbers, most of the SMMEs in Ga-Rankuwa are either survivalist or micro enterprises. The Innovation Hub shows a strong trend towards medium enterprises whereas the CSIR and Watloo enterprises show a bell-shaped spread across medium and small enterprises.

3.3 TECHNOLOGY MANAGEMENT

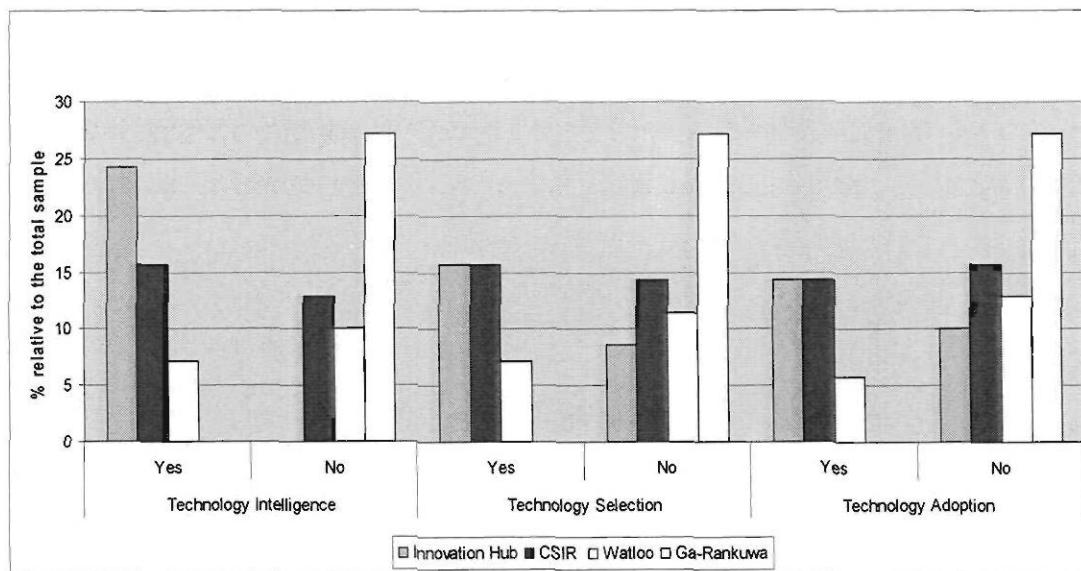
As discussed in chapter 2, technologies and the appropriate use thereof by SMMEs can be a competitive advantage. The questionnaire classifies the SMMEs in terms of the various technology management instruments as previously identified in Chapter 2. **Table 3.6** attempts to identify the use of various technology management tools in the SMME sample.

3.3.1 Technology management instruments

TABLE 3.6: TECHNOLOGY MANAGEMENT INSTRUMENTS (N=70)

	Technology Intelligence		Technology Selection		Technology Adoption	
	Yes	No	Yes	No	Yes	No
Innovation Hub	17	0	11	6	10	7
CSIR	12	9	11	10	10	11
Watloo	6	7	5	8	4	9
Ga-Rankuwa	0	19	0	19	0	19

FIGURE 3.6: TECHNOLOGY MANAGEMENT INSTRUMENTS (N=70)



According to the data received, contrasting observations can be made; for example, the Ga-Rankuwa centre appears not to be using any of the identified technology management instruments whereas the Innovation Hub shows more than 50% use of the identified technology management instruments. The CSIR shows an almost 50:50 split, which is followed by the Watloo centre that shows more than 50% of the enterprises not using any of the identified technology management instruments.

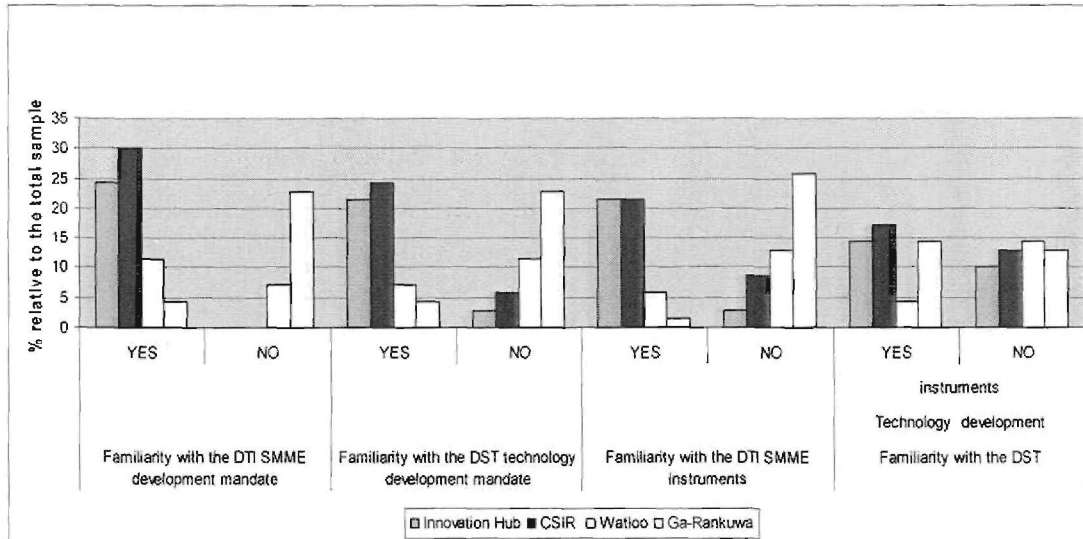
3.3.2 Awareness of government technology support services

The DTI and the DST have been identified by the literature study as key departments responsible for technology support for SMMEs. Thus, the awareness by SMMEs of these key line function departments as well as the various supporting instruments they use is important to them.

TABLE 3.7: AWARENESS OF GOVERNMENT'S LEAD AGENCIES SUPPORTING SMMEs AND THEIR SUPPORTING INSTRUMENTS (N=70)

	Determining familiarity with the government's lead agencies in SMME technology support as well as familiarity with their support instruments							
	Familiarity with the DTI SMME development mandate		Familiarity with the DST technology development mandate		Familiarity with the DTI SMME instruments		Familiarity with the DST Technology development instruments	
	Yes	No	Yes	No	Yes	No	Yes	No
Innovation Hub	17	0	15	2	15	2	10	7
CSIR Industrial Park	21	0	17	4	15	6	12	9
Watloo Industrial Complex	8	5	5	8	4	9	3	10
Ga-Rankuwa Industrial Park	3	16	3	16	1	18	10	9

FIGURE 3.7: AWARENESS OF GOVERNMENT'S LEAD AGENCIES SUPPORTING SMMEs AND THEIR SUPPORTING INSTRUMENTS (N=70)



The data received indicates that the SMMEs in the CSIR Industrial Park and the Innovation Hub show a high level of awareness not only of the key lead government departments in charge of SMME technology development but also that these SMMEs are also familiar with the various services and products that are offered through these departments. This can, however, not be said for the Watloo and Ga-Rankuwa Industrial Parks, which show a lesser understanding of these agencies as well as their service offerings.

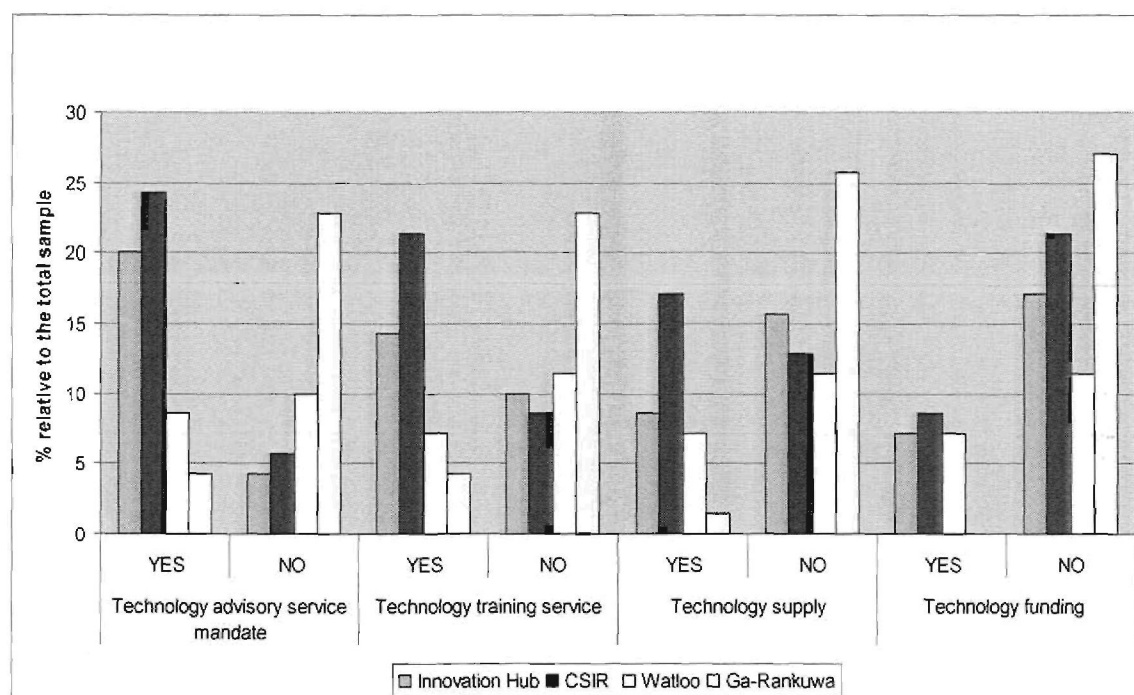
3.3.3 Determining the type of support received

The various SMME and technology programmes of the DTI and the DST offer a wide variety of products. This aspect of the questionnaire attempts to determine the type of technology services received and used by the SMMEs.

TABLE 3.8: DETERMINING THE TYPE OF SUPPORT RECEIVED (N=70)

	Determining the type of support received from the government							
	Technology advisory service		Technology training service		Technology supply		Technology funding	
	Yes	No	Yes	No	Yes	No	Yes	No
Innovation Hub	14	3	10	7	6	11	5	12
CSIR	17	4	15	6	12	9	6	15
Watloo	6	7	5	8	5	8	5	8
Ga-Rankuwa	3	16	3	16	1	18	0	19

FIGURE 3.8: DETERMINING THE TYPE OF SUPPORT RECEIVED (N=70)



According to the data above, the various interventions are used across the selected industrial parks. Specific observations that have been made are:

- The SMMEs in the CSIR and the Innovation Hub Industrial Parks appear to be using the full spectrum of services offered by the two departments.
- The use is lower when it comes to the supply and funding that is related to these technologies.
- The trend is different in the case of Watloo Industrial Park, which shows an almost steady use across all service offerings.
- The trend in the case of the Ga-Rankuwa Industrial Park indicates a lesser use of these services, in particular the funding support.

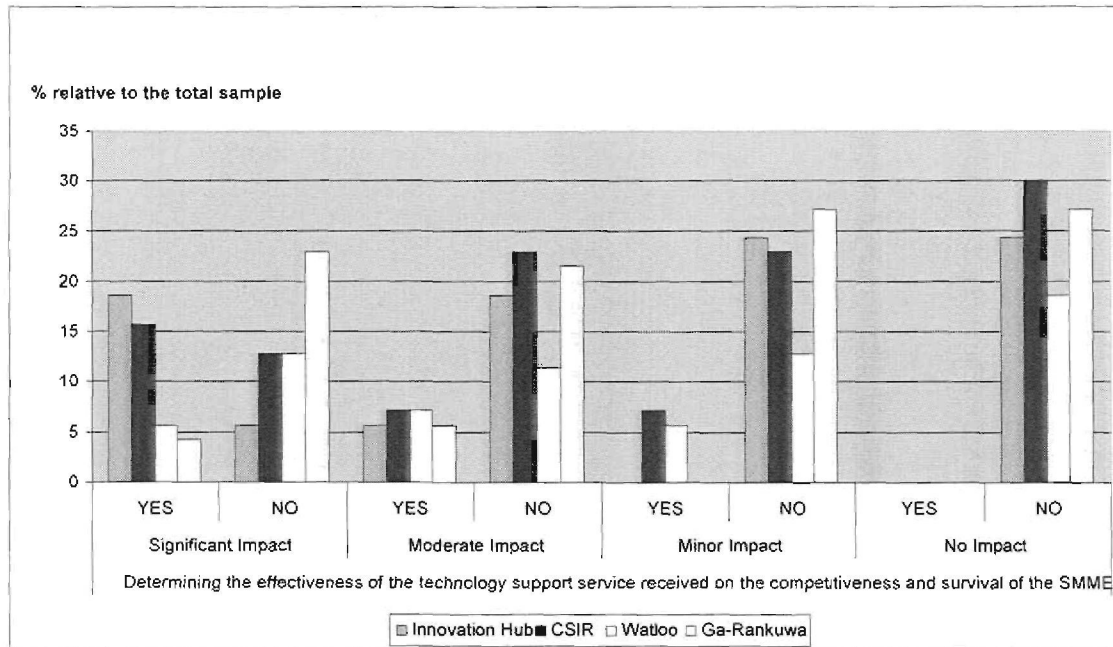
3.3.4 Determining the SMMEs' perceptions of the impact of the services offered

The question attempts to establish from the SMMEs if services received from government indeed have an impact on the competitiveness of their business.

TABLE 3.9: DETERMINING FROM THE SMMEs WHETHER THE SMME TECHNOLOGY SUPPORT SERVICES HAD AN IMPACT ON THE COMPETITIVENESS OF THE SMME (N=70)

	Determining the effectiveness of the technology support services received on the competitiveness and survival of the SMME							
	Significant Impact		Moderate Impact		Minor Impact		No Impact	
	Yes	No	Yes	No	Yes	No	Yes	No
Innovation Hub	13	4	4	13	0	17	0	17
CSIR	11	9	5	16	5	16	0	21
Watloo	4	9	5	8	4	9	0	13
Ga-Rankuwa	3	16	4	15	0	19	0	19

FIGURE 3.9: DETERMINING FROM THE SMMEs WHETHER THE TECHNOLOGY SUPPORT SERVICES HAD AN IMPACT ON THE COMPETITIVENESS OF THE SMME (N=70)



The data indicates that, according to the SMMEs, when the services were rendered there was a positive impact on the competitiveness of the SMME, which bodes well for the interventions offered by these two departments. None of the SMMEs at the four centres registered any discontent with value of the services and products offered.

3.4 DETERMINING THE EXTENT OF TECHNOLOGY DEVELOPMENT IN SMMEs

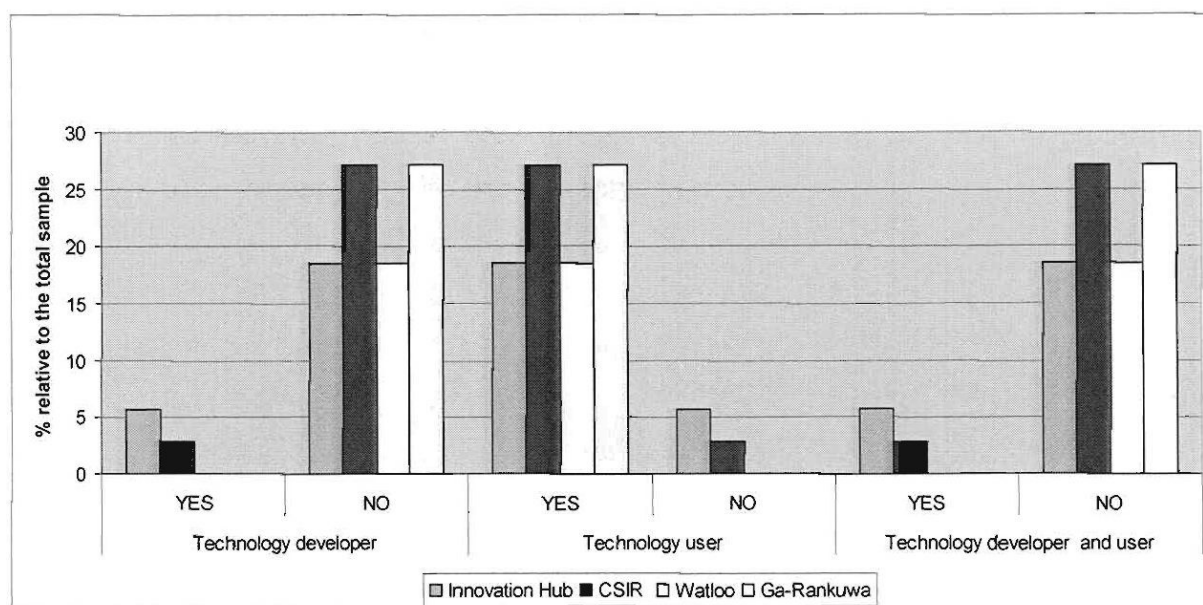
This aspect of the questionnaire attempted to establish whether SMMEs conduct any technology development and the selling thereof as part of their business.

3.4.1 Determining whether the SMMEs are focused on technology as saleable product or whether they are only focused on the use of technologies

TABLE 3:10: DETERMINING WHETHER THE SMMEs ARE ALSO FOCUSED ON TECHNOLOGY AS SALEABLE PRODUCT OR WHETHER THE SMMEs ARE ONLY TECHNOLOGY USERS (N=70)

	Is your business focusing on technology as a tradable commodity or is your business only a technology user?					
	Technology developer		Technology user		Technology developer and user	
	Yes	No	Yes	No	Yes	No
Innovation Hub	4	13	13	4	4	13
CSIR	2	19	19	2	2	19
Watloo	0	13	13	0	0	13
Ga-Rankuwa	0	19	19	0	0	19

FIGURE 3.10: DETERMINING WHETHER THE SMME IS ALSO FOCUSED ON TECHNOLOGY AS SALEABLE PRODUCT OR WHETHER THE SMMEs ARE ONLY TECHNOLOGY USERS (N=70)



It can be concluded, based on the data that the SMMEs in the four industrial parks investigated, focused primarily on the use of technologies with a limited focus on the development of these technologies. This is obviously an area of concern, particularly for the two line function departments whose mandate it is to increase innovation in the South African economy.

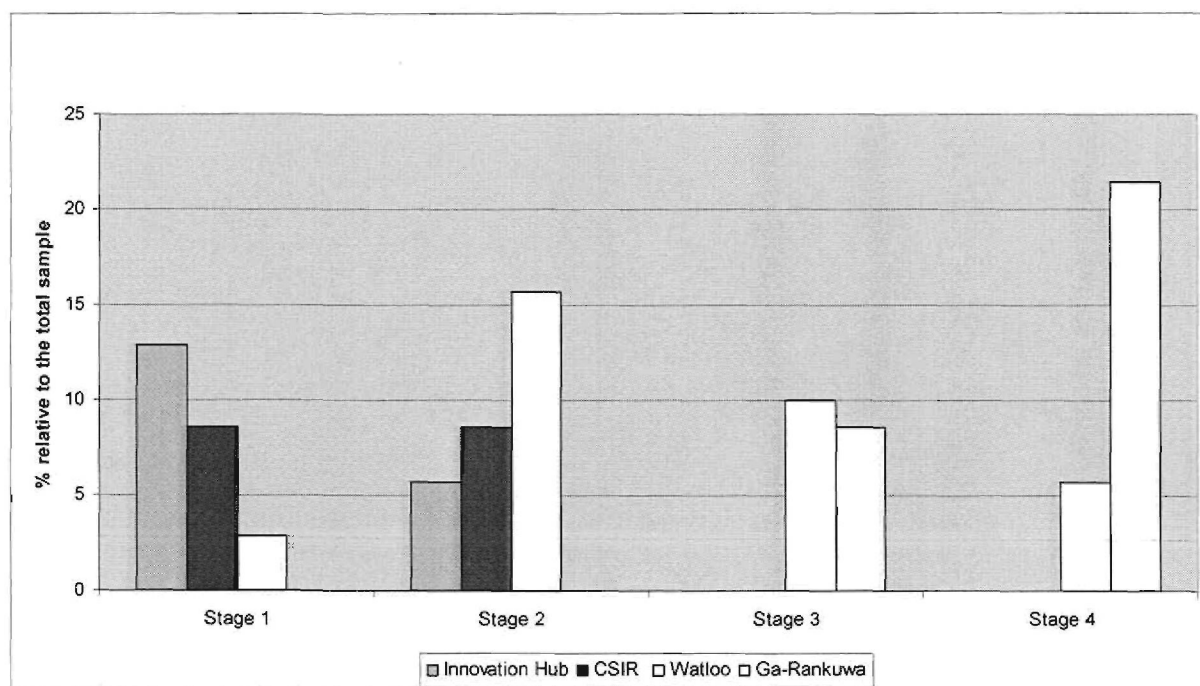
3.4.2 Plotting the SMMEs on the technology S-curve

The positioning of the SMMEs on the technology S-curve is a good indicator of the approach that the SMMEs take on technology management. The plotting on the S-curve attempts to elucidate this understanding.

TABLE 3:11: PLOTTING THE SMMEs ON THE TECHNOLOGY S-CURVE (N=70)

	Plotting the SMMEs on the technology S-curve			
	Stage 1	Stage 2	Stage 3	Stage 4
Innovation Hub	9	6	2	0
CSIR	4	6	11	0
Watloo	0	0	7	6
Ga-Rankuwa	0	0	4	15

FIGURE 3:11: PLOTTING THE SMMEs ON THE TECHNOLOGY S-CURVE (N=70)



Using the technology S-curve to identify the technology position of the SMMEs, the following observations can thus be made:

- There is technology development occurring; however, this is only limited to the CSIR and the Innovation Hub industrial centres that are predominantly in stage 1 and 2 of the S-curve.
- The other two centres are more in stage 3 and 4 of the technology curve, indicating that they are more inclined to the use of these technologies.

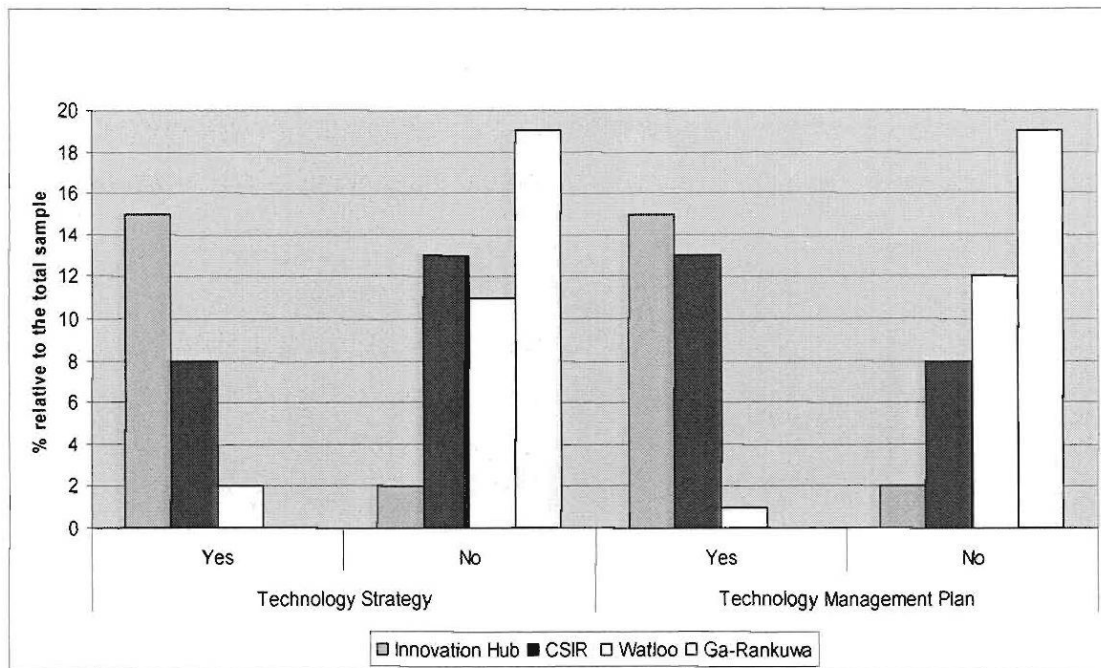
3.4.3 Technology strategy and management plan

This section attempts to determine if the SMMEs have a technology strategy and a management plan to support the strategy. One of the indicators that one can use to determine if SMMEs are using technologies as a competitive advantage is to determine the management approach taken by the SMMEs on technologies.

TABLE 3.12: DETERMINING WHETHER THE COMPANY HAS A TECHNOLOGY STRATEGY AND OR MANAGEMENT PLAN (N=70)

Do companies have a technology management strategy and or plan?				
	Technology Strategy		Technology Management Plan	
	Yes	No	Yes	No
Innovation Hub	15	2	15	2
CSIR	8	13	13	8
Watloo	2	11	1	12
Ga-Rankuwa	0	19	0	19

FIGURE 3.12: DETERMINING WHETHER THE COMPANY HAS A TECHNOLOGY STRATEGY AND OR MANAGEMENT PLAN (N=70)



According to the data received, it would appear that the active management of technologies is only limited to the CSIR and the Innovation HUB Industrial Parks. Data received from the other two centres indicate that there are no technology management plans.

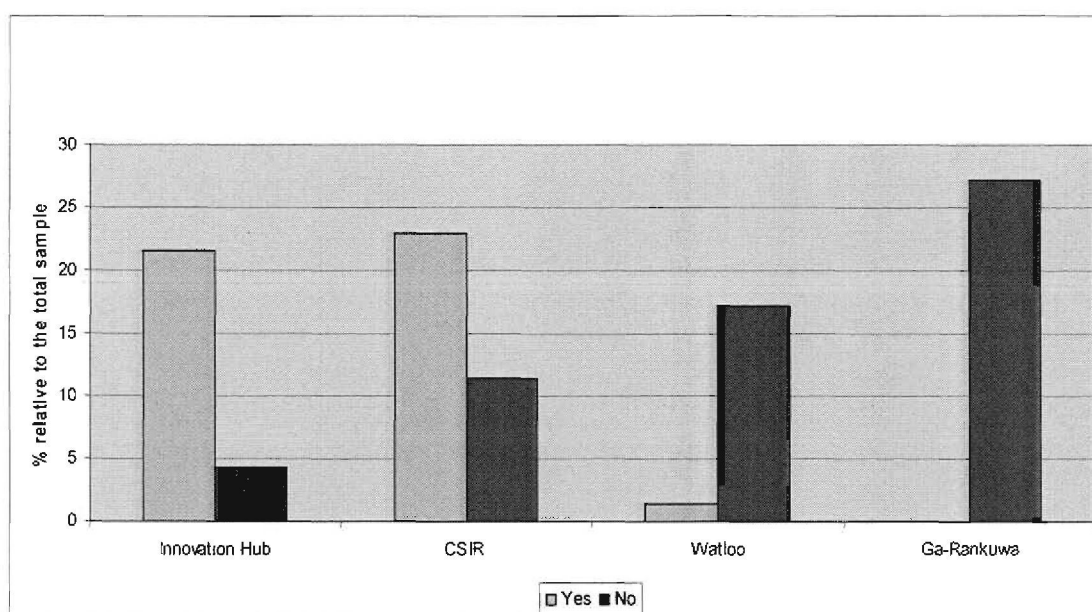
3.4.4 Resourcing of the technology management aspects of SMMEs

This question attempts to establish the commitment of management in implementing their technology management plan by ensuring adequate resources are in place.

TABLE 3.13: DOES YOUR COMPANY HAVE A DEDICATED PERSON AND OR RESOURCES TO MANAGE ALL ASPECTS OF YOUR BUSINESS'S TECHNOLOGY (N=70)?

	Does your company have a dedicated person and or resources to manage all aspects of your business's technology?	
	Yes	No
Innovation Hub	15	3
CSIR	16	8
Watloo	1	12
Ga-Rankuwa	0	19

FIGURE 3.13: DOES YOUR COMPANY HAVE A DEDICATED PERSON AND OR RESOURCES TO MANAGE ALL ASPECTS OF YOUR BUSINESS'S TECHNOLOGY (N=70)?



According to the data received, it would appear that earmarking of resources to implement the management of technologies is only limited to the CSIR and the Innovation Hub Industrial Parks. Data received from the other two centres indicates that there is no technology manager or dedicated resources for technology management.

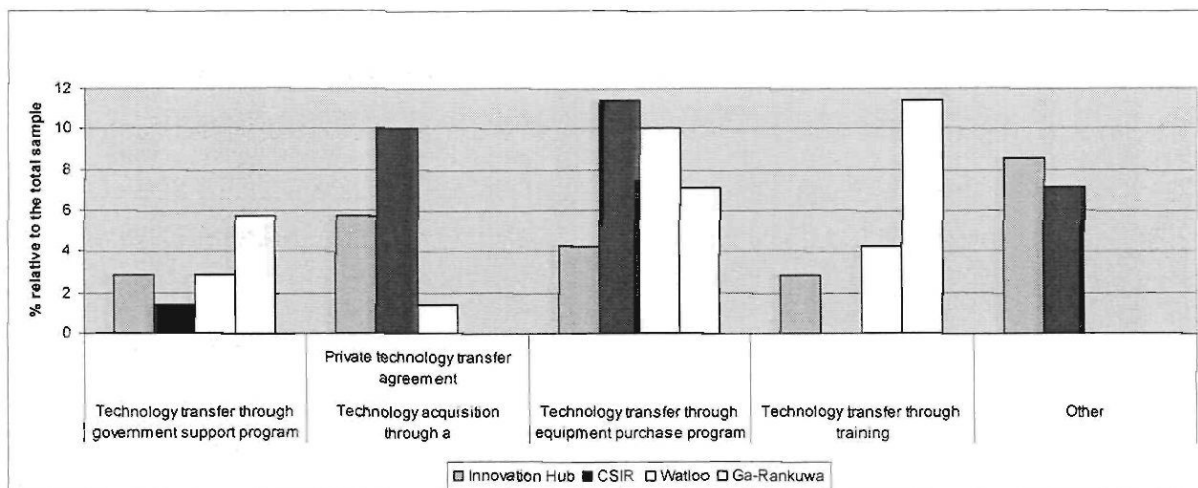
3.4.5 Determining how the SMME technology needs are met

The question attempts to establish the technology transfer mode that the SMMEs use, since there are various options which SMMEs can use in assimilating technologies.

**TABLE 3.14: DETERMINING HOW THE SMME TECHNOLOGY NEEDS ARE MET
(N=70)**

	Determining how the SMME technology needs are met				
	Technology transfer through government support programme	Technology acquisition through a private technology transfer agreement	Technology transfer through an equipment purchase programme	Technology transfer through training	Other
Innovation Hub	2	4	3	2	6
CSIR	1	7	8	0	5
Watloo	2	1	7	3	0
Ga-Rankuwa	4	0	5	8	0

FIGURE 3.14: DETERMINING HOW THE SMMES' TECHNOLOGY NEEDS ARE MET (N=70)



The data indicates that the four industrial parks appear to have preferences that can be separated into two categories:

- Technology transfer that is dependent on interventions provided by the two lead departments of government; and
- Technology transfer that is not dependent on government support programmes such as technology transfer through private agreements.

Based on the data, it would appear that the first option is being utilised across all four industrial parks; however, it is important to note that the other avenues such as private technology transfer are also being used. This means that whilst the CSIR and Innovation Hub do use government support, they are not necessarily entirely dependent on it, only for accessing technologies. In terms of the other two centres, they appear to be heavily reliant on interventions that are government-led.

3.4.6 Determining which technology acquisition method SMMEs would most likely use in future

The question attempts to establish from the SMMEs which technology acquisition method are they likely to use in the future.

TABLE 3.15: WHICH OF THE TECHNOLOGY ACQUISITION METHODS WOULD YOU MOST LIKELY USE IN THE FUTURE (N=70)?

	Which of the technology acquisition methods would you most likely use in the future?				
	Technology transfer through government support programmes	Technology acquisition through a private technology transfer agreement	Technology transfer through an equipment purchase programme	Technology transfer through training	Other
Innovation Hub		●			●
CSIR	●	●			●
Watloo	●		●	●	
Ga-Rankuwa	●		●	●	

According to the data, the following preferences were observed:

- Dependence on technology support through government interventions is supported by all the industrial parks with the exception of the Innovation Hub.

- The preference for technology acquisition through a private technology purchase agreement is limited to the more advanced industrial parks like CSIR and the Innovation Hub.
- The use of training as a means to acquire technology know-how is specifically preferred by the less developed industrial parks like Ga-Rankuwa as well as Watloo.

The data analysis confirms the earlier observation that the SMMEs at the CSIR and the Innovation Hub seem to have alternative technology support outside the government programme.

3.5 CONCLUSION

In conclusion the empirical research sets off, as guided by the objectives of the study to elucidate the SMME technology access challenges, and the government technology development challenges as identified in the problem statement and literature survey. The empirical survey accomplished its intended objective of gathering both quantitative and qualitative data on the two objectives of the study. In order to allow for a detailed analysis of the SMME sample, there is first a classification of the various SMME's in accordance with the DTI SMME classification categories. The research project through the various questionnaire allowed for further data sets to be gathered which allowed for an accurate determination of the level of technology access by the various sample SMME's as well as the determination of technology development activities within the SMMEs. Since the data was gathered through a single questionnaire as well as single data collector and capturer, it can be concluded that the entire data accuracy and precision was reasonable. An interesting picture emerges from the acquired data that sheds some useful insight into not only the types of SMME's existing within the various industrial parks but also the spectrum of technology challenges they face.

3.6 SUMMARY

The survey questionnaire was designed to gather empirical data as defined in the problem statement and the two research objectives. The first focal area of the empirical research was the identification of the types of SMMEs operating in the industrial complexes selected for the study. In this regard, the set of questions was designed to solicit information pertaining to critical attributes of SMMEs as determined by the DTI classification. The survey then focused on elucidating the technology management modalities of SMMEs as well as how these related to the current government-led SMME technology interventions. As per the problem statement, the survey concluded by investigating technology development within the SMME sector.

CHAPTER 4

CONCLUSION AND RECOMMENDATIONS

4.1 INTRODUCTION

The intent of the study as captured in the problem statement was to investigate the shortcomings of the current South African government-led SMME technology interventions in relation to the local SMME sector. In pursuit of this objective, the study adopted a two-pronged approach: the first being an investigation of the technology access challenges as perceived by the SMME sector, and the second being the lack of technology development within companies as identified by government. The study thus attempts to investigate this technology problem from two perspectives, being:

- The SMMEs who are the intended beneficiaries of the technology support intervention; and
- The government who is the provider of the technology support services.

The literature study examined and described the general South African technology challenges; key stakeholders were identified as well as the relationships within which these stakeholders function. In addition, a specific perspective of the SMME technology challenge was also provided as part of the literature survey. Key questions, as asked through the questionnaire in the empirical research, elucidated some of the concerns identified in the literature study.

4.2 LITERATURE REVIEW KEY FINDINGS

Guided by the objectives of the literature survey, which was limited to information sources in South Africa, led to the following findings:

4.2.1 South African technology challenge

According to the literature, South Africa does indeed experience a technology challenge. The challenge captured in the “innovation chasm” as described by Coetzee and Phohole (2006:106), provides a description of the weakness in South African technology management processes, and is as follows:

- R&D activities in South Africa are only at the manufacturing end of the product life cycle, most of which are imported products. This approach, which is limited to the maintenance of products, neglects the development of novel or new products. This is unlike the industrialized or developed countries, which tend to have R&D activities that cover the whole product life cycle; that is, from concept development to final production.
- There is a misalignment of research initiatives in South Africa, with the relatively limited group of local research activities informed by overseas challenges instead of local industry imperatives. This not only indicates an inadequate research capacity, but this is also misaligned to local industries' priorities.
- South Africa is a net importer of technology due to the large inflow of technology from industrialized countries in the form of licensed product designs, processes, sub-assemblies and final products.
- There is an insignificant or weak inter-flow of technology between the local R&D community and the local industrial sector, which leads to a limited influence of the research agenda by the R&D needs of the local industries. There is, instead, some communication between local and foreign R&D communities, which leads to the misalignment of research priorities as indicated above.

This aspect of the literature survey validates government's concern captured in the secondary objective of the study. The literature survey indicated that there is inadequate research and development being conducted in South Africa to the

extent that measures have now been put in place to drive the research and development spend of South to 1% of the GDP by the end of 2008.

4.2.2 The SMME technology challenge

The literature survey further investigated the technology challenge from the SMME perspective. In this case, the technology S-curve was used as a tool for tracking the participation of SMMEs on the technology development trajectory. The technology development trajectory is made up of four phases of technology development. These stages of technology development are:

- Stage 1:** Technology application development and trial implementation;
- Stage 2:** Early adoption of the technology for commercial applications;
- Stage 3:** Rapid commercialisation of the technology and market penetration, and
- Stage 4:** Late adopters acquire the technology as it saturates the market.

The literature survey indicated that, except for the first stage of the technology S-curve, SMMEs are in fact poorly represented in the other three phases of technology development. It is of interest to note that it is in these three stages that the full commercial value of these technologies is exploited; as such, this lack-lustre performance is potentially implying a missed commercial opportunity for SMMEs. In summary, the literature survey further confirmed the existence of the technology challenges from the SMME perspective as indicated in the primary objective of the study.

4.3 SURVEY QUESTIONNAIRE KEY FINDINGS

The survey used the generic DTI SMME classifications as a basis for understanding the various SMMEs within the industrial complexes investigated. As per the DTI categories, the SMMEs were thus classified in terms of:

- Income;
- Capital invested;
- Registration in terms of the Companies Act as well as VAT;
- Number of employees; and
- The type of training for employees.

On the basis of the analysed data, the SMMEs can be separated into four categories based on the abovementioned classifications. It is observed that the SMMEs are well represented across the four categories of SMMEs as envisaged in the DTI systems (**Figure 3.1 - 3.5**). The sample population can be split into two main groupings, which are survivalist and micro enterprises, mostly in Ga-Rankuwa and Watloo Industrial Complexes as well as the small and medium enterprises in CSIR and the Innovation Hub.

4.3.1 Survey questionnaire relative to the primary objective being the investigation of the lack of access to technology support services

The approach adopted in the questionnaire in investigating this aspect was to first establish the use of three typical technology management instruments, as described in the literature review. The questionnaire thus investigated across all the SMMEs in the sample, the existence of the following three technology management instruments (**Figure 3.6**). These are:

- Technology intelligence;
- Technology selection; and
- Technology adoption.

The following observations were made on the basis of the data analysed. The SMMEs in Ga-Rankuwa lacked all three identified technology management instruments, which also correlated with a lack of awareness of the DTI and the DST SMME and technology support services (**Figure 3.7**). The opposite was however observed with regard to the SMMEs in the Innovation Hub, which showed complete use of all three abovementioned technology management instruments. The Innovation Hub SMMEs also demonstrated complete awareness not only of the DST and DTI mandates but also the various services offered by the two respective line function departments. On the other hand, CSIR showed an almost 50:50 split in the use of the technology management instruments, whereas the Watloo Industrial Park showed weak use of the instruments. Once more, these observations also correlate with the indifferent awareness levels of the support services offered by the DTI and the DST. In conclusion, notwithstanding the observations made with regard to the SMMEs in the Innovation Hub, the following general observations can be made in relation to the primary objective, and these are that there is indeed a general lack of access to technology management instruments in SMMEs. One of the factors that this can be attributed to is the lack of awareness of the SMME and technology services offered by the DTI and the DST.

In addition to the above aspect of the survey, observations in **Figure 3.8** show the type of services received. This is further confirmed by the following two points:

- That there is limited support of SMMEs with regard to the technology funding as well as supply of appropriate technologies; and
- That there is support for SMMEs with regard to the technology advisory services as well as training. This service, though provided, seems inadequate, particularly for the SMMEs in Ga-Rankuwa who, coincidentally are the ones that need this support the most.

4.3.2 Survey questionnaire relative to secondary objective being the lack of technology development within companies

Similar to the survey questionnaire above, this aspect investigated the extent of technology development within the SMMEs by inquiring if the SMMEs were also involved in the development of technologies as a saleable product (**Figure 3.10**). Based on the data, it can be concluded that the SMMEs within all four centres demonstrated very weak technology development, and rather showed a marked inclination of being technology users. This further confirms the concerns raised by government as indicated in the literature review through the R&D strategy that, indeed South African companies lack in the development of technologies. This, as raised in the literature survey, is leading South Africa to be a net importer of foreign technologies. Thus the problem raised at the commencement of the study, that there seems to be a lack of technology development within the SMME sector, was in fact **confirmed by both the literature survey as well as the empirical research.**

4.3.3 Anomalies in the survey questionnaire findings

The questionnaire survey, however, reveals an anomaly when one considers the plotting of the SMMEs on the technology development S-curve. On the basis of the observation and conclusion made above, that is, that the SMMEs do not participate in the development of new technologies, it is rather surprising to note the high level of SMMEs in the first stage and second stage of the S-curve (**see Figure 3.11**). One possible explanation for the anomaly is that these SMMEs, though not directly involved in technology development, may instead be participating in the testing of new equipment and or technologies, explaining the surprising position on the technology S-curve.

4.4 DISCUSSION

The four centres showed a varying level of response with regard to the technology support processes. It would appear that the Innovation Hub and the CSIR Industrial

Park have better access, and as a consequence are using the services more than the other two centres. On the other hand, it must also be noted that these centres do not necessarily always need these services as much as the other two centres, since they have access to other external support based on their physical location. This confirms the earlier concerns about the limitations of the government interventions, which assumes a 'one size fits all' approach to what is in fact quite a diverse and varying SMME sector, as confirmed by the DTI SMME classification system. On this basis, it can be further argued that whilst the services are generally used, the use is not necessarily at an optimal level and there could in fact be a possibility that some of the services rendered are not necessarily crucial to some of the advanced industrial parks such as the Innovation Hub and the CSIR.

On the basis of the data received, it can be concluded that these government-led technology support programmes are effective, as all four industrial parks indicated that they value the support they are getting. It must, however, also be noted that this perceived effectiveness is limited to the one aspect of technology management, which is technology transfer, as all the industrial parks have had success in acquiring new technologies through these interventions. It has, however, also been observed that these technology support programmes have not been successful in increasing the level of technology development as per the concern raised in the R&D strategy, since the data received indicates that this is an area still lagging behind in terms of technology management.

South Africa is a country of many disparities with some aspects being representative of a modern first world economy whilst some aspects are representative of a third world economy. As such, interventions copied from first world countries may be inappropriate if they do not recognise these disparities. The SMME sector and its technology needs are no exception; as such, the current SMME support interventions appear to have mistakenly assumed a homogenous population of SMMEs and thus worked on a "one size fits all" approach, which has not necessarily adequately responded to the unique technology needs of a varying SMME sector.

One of the South African government policy objectives indicates that the SMME sector is one of the possible avenues that could be used to address the unemployment challenges of the country. The R&D policy correctly identifies the role of technologies in the survival and competitiveness of SMMEs; however, based on the literature survey as well as the questionnaire, it would appear the success rate in addressing the challenge is rather low.

The data received confirms what has become a huge concern of the current South African government, which is jobless economic growth. In this instance, the interventions have allowed increased survival and competitiveness of the SMMEs; what is unfortunate is that by focusing on high-tech SMMEs the government could also by default be fuelling the unemployment challenge. The argument that can be put forth to explain this is that technology-intensive businesses and operations tend to rely heavily on automation and advanced manufacturing processes. These, by their nature, do not need massive manpower, but rather a few but highly skilled operators. To a certain extent, one can further argue that these two objectives are, in fact, in conflict with each other.

The following reasons can be postulated as possible causes for the rather limited success rate in both areas of policy intervention; that is, SMME development and technology development.

- **Postulate 1 – Lack of customised solutions**

The current policy interventions for SMME development as well as technology development fail to recognise the varying socio-economic conditions of South Africa. This is based on the varying observation of the SMMEs in the selected industrial parks, which confirm the different socio-economic circumstances that these SMME operate in. Thus, any policy intervention that fails to recognise the reality is bound to have limited success.

- **Postulate 2 – Lack of sufficient case studies to adequately inform policy development**

Since the previous government policy interventions were focused on large industries during the isolation phase of the country, it is likely that there is inadequate experience on SMME and technology support models that could be applicable to South Africa. The current government has been exploring models borrowed elsewhere, which may also be failing to recognise the socio-economic circumstances of South Africa.

- **Postulate 3 – Current government interventions lack focus**

Whilst it makes sense to integrate the SMME and technology mechanisms into one agency, for example, SEDA, it is also likely that this may be leading to a lack of focus of the intervention, particularly if one considers technology development needs.

- **Postulate 4 – The centralization of SMME and technology support at national government level weakens the role of the other spheres of government**

The centralisation of SMME support and technology in the DST and DTI may be limiting the provincial and local authorities in supporting SMME and technology development. Considering that Gauteng is one the strongest provinces financially and also has an abundance of HEIs, the current SMME and technology interventions should have been addressed.

- **Postulate 5 – Inadequate use of infrastructure**

There is inadequate use of infrastructure; the literature survey provided an international perspective of SMME technology development, which uses technology infrastructure as a basis for the intervention. As previously indicated, Gauteng is well endowed with HEIs; these resources appear not to be recognised in the Gauteng SMME interventions. This may not be unique to the Gauteng province only.

4.5 RECOMMENDATIONS

Based on the abovementioned potential areas of weakness, the following recommendations are made:

1. There is a need to further enhance SMME and technology policy development at provincial and local government level to allow for flexibility in order to address local circumstances;
2. More pilot studies need to be conducted to enhance knowledge on appropriate SMME and technology solutions;
3. Whilst integration of services is important, the current government interventions should be revised to address specific challenges faced by SMMEs. The “one size fits all” approach does not always work;
4. A plan needs to be developed to integrate and optimize HEIs in SMME and technology development work; and
5. One of the options that should be considered is to have a two-pronged strategy that focuses only on job creation at the micro enterprise level whilst pursuing technology advancement in the medium enterprises.

4.6 RECOMMENDATIONS FOR FUTURE STUDIES

The information gathered through this study could be complemented by a similar study; however, such study could be developed in one of Gauteng’s smaller cities to see if similar observations can be made, or alternatively, in another province.

4.7 SUMMARY

The chapter considered and evaluated key findings emanating from the literature survey as well as the empirical research that was conducted during the course of the study. The literature study as well as the empirical research both lead to the same conclusion regarding the problem statements raised in Chapter 1 on SMME technology support and technology development. On the basis of the literature survey and empirical research findings, the following conclusions were then reached:

1. The current government SMME technology interventions do not adequately meet the technology needs of the SMMEs; and
2. There is insufficient or a lack of technology development within the SMME sector.

Limitations of the current interventions relating to technology development were then identified, as well as recommendations on a set of interventions that could be employed to reverse this negative trend. In addition to the recommendations, a proposal was made on possible future research areas for further investigations, which could complement the findings of the current research project.

4.8 CONCLUSION

Based on the literature survey as well as the empirical research, the following conclusions were reached:

1. There is a challenge for SMMEs regarding access to technologies; and
2. There is inadequate technology development in the SMME sector.

The research project, based on what was established through the literature review and the empirical research, established that there is a technology access challenge for SMMEs. This could be partly responsible for the slow growth of the SMME sector. This slow growth could be indirectly contributing negatively to the South African unemployment challenge. The research further concludes through both the literature survey and the empirical research that there is limited technology development in the SMME sector, which leads to South Africa being a net importer of technologies. A set of factors contributing to these challenges are put forth, most of which point to shortcomings or limitations in policy development, institutional arrangements and general developmental challenges. Whilst these areas of concern are raised, the research project provides an overview of options used elsewhere in the world which should be used to address the South African challenges.

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APPENDIX A: QUESTIONNAIRE

ANALYSIS OF TECHNOLOGY SUPPORT SERVICES FOR SMALL AND MEDIUM SIZED ENTERPRISES IN SELECTED INDUSTRIAL PARKS OF PRETORIA

Date: _____

Industrial Complex _____

Name of SMME: _____

Contact Person _____

Designation _____

SECTION 1: CLASSIFICATION OF SMME'S IN TERMS OF THE DTI SMME CATEGORIES:

1. What is the annual income of the company?	< R 10 000 ☐ <R 50 000 ☐ <R250 000 ☐ >R250 000
2. What is the total capital invested in the company?	< R 10 000 ☐ <R 50 000 ☐ <R250 000 ☐ >R250 000
3. What type of training do your employees get?	None ☐ Informal ☐ Formal on the job ☐ Formal and External ☐
4. Is your company registered in terms of the companies act?	Yes ☐ No ☐
5. Is your company registered for VAT?	Yes ☐ No ☐
6. How many employees does your company have (see DTI categories)?	Survivalist ☐ Micro enterprise ☐ Small enterprise ☐ Medium enterprise ☐

SECTION 2: TECHNOLOGY MANAGEMENT

1. Does your company use any of these technology management instruments: Technology Intelligence (TI), Technology Selection (TS) and Technology Adoption (TA).	TI ☐ TS ☐ TA ☐
2. Are you familiar with the DTI technology development mandate	Yes ☐ No ☐
3. Are you familiar with the DST technology development mandate	Yes ☐ No ☐
4. Are you familiar with the DTI technology development instruments?	Yes ☐ No ☐
5. Are you familiar with the DST technology development instruments?	Yes ☐ No ☐
6. What type of technology services did you receive? Technology advisory services (TAS), Technology training services (TTS), Technology supply (TS) and Technology Funding (TF).	TAS Yes ☐ No ☐ TTS Yes ☐ No ☐ TS Yes ☐ No ☐ TA Yes ☐ No ☐
7. What was the impact of the technology services on the competitiveness of your business?	Significant Yes ☐ No ☐ Moderate Yes ☐ No ☐ Minor Yes ☐ No ☐ No impact Yes ☐ No ☐
8. What is the focus of your business technology activities? Technology developer (TD), Technology user (TU) and technology developer and user (TD&U).	TD Yes ☐ No ☐ TU Yes ☐ No ☐

9. Considering the technology S-curve where would plot your organisation? (Please note the stages of the technology S-curve will be described by the interviewer). 10. Does your company have a technology strategy and or management plan? 11. Does your company have a dedicated person to manage all technology aspects of your business? 12. How are the technology needs of your company met? 13. What technology development acquisition method are you likely to use in the future	TD&U Yes ☐ No ☐ Stage 1 ☐ Stage 2 ☐ Stage 3 ☐ Stage 4 ☐ Tech.man. strategy Yes ☐ No ☐ Tech.man. plan Yes ☐ No ☐ Yes ☐ No ☐ Government Support ☐ Private transfer agreement ☐ Transfer equipment ☐ Training ☐ Other ☐ Government Support ☐ Private transfer agreement ☐ Transfer equipment ☐ Training ☐ Other ☐
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