Exploratory Study of the Impact of Research and Development Tax Incentives in South Africa

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ABSTRACT

The intention of this dissertation is to explore the impact of research and development (R&D) tax incentives in South Africa in the context of the objectives of the government and the experience of companies. This qualitative study investigated the impacts of R&D tax incentives on financial performance competitiveness, and on R&D investment patterns. It was also able to identify factors that might inhibit the R&D tax incentive programme from realising its full potential.

The main findings of the study suggest that firms in South Africa benefit through improved cash flow and enhanced competitiveness. This package of incentives served as a motivation for small, medium and micro enterprises (SMMEs) to undertake R&D investments. The inhibiting factors include interpretative uncertainty with regard to qualifying criteria and the misalignment between firm level R&D strategies and the additional cash flow derived from R&D tax incentive. The study suggests that these are the main challenges to be addressed by firms and policy makers.

The results also provide strong support for restructuring the tax incentive process so that there is pre-screening and qualification by the Department of Science and Technology before progressing to the tax authorities. This change would have a dramatic effect on improved effectiveness of the overall system. Firms would appreciate the increased certainty and reduction in interpretative fuzziness.

DECLARATION

I, Tshotleho Petrus Letaba, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

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Tshotleho Petrus Letaba

Signed at …Johannesburg……

On the ……03…….. day of ……June……. 2011

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this study is to explore the impact of research and development (R&D) tax incentives at the company level in South Africa. This research is valuable because it has the potential to identify any weaknesses in important policy measures and to suggest recommendations for policy makers and firm decision makers. Since its launch in November 2006, there has not been an evaluation of the R&D tax incentive programme. There are a number of studies on similar programmes in several developed countries around the world and this literature is used to guide this exploratory study. Several dimensions of measurement, as derived from the literature, are used to explore the impact of R&D tax incentives, so called Section 11D incentives, on the key innovation challenges facing firms.

1.2 Context of the study

The R&D tax incentive was announced by National Treasury (2006) in its 2006/07 Budget Tax Proposal. This proposed R&D tax incentive was in the form of 150% deduction on operational R&D expenditure and accelerated depreciation of R&D assets from 40:20:20:20 to 50:30:20. This measure was proposed in response to the 2002 National Research and Development Strategy (NRDS). It noted major weaknesses within the National System of Innovation (NSI) including declining R&D expenditure by private firms over four consecutive years; this stood at 0.41% of GDP (government at 0.29%) in 2002 compared to 1.15% of GDP (1% for government) as an average of Organisation of Economic Cooperation and Development (OECD) countries (Department of Science and Technology 2002).

The main target within the NRDS was to achieve 1% R&D expenditure as a percentage of GDP by 2008, the results of which already indicated the decline to 0.92% in the 2008/09 R&D Survey. This target can be traced back to the

1980 Lagos Action Plan which had two objectives, viz.: the achievement of economic cooperation through integration and through self-reliance among African countries (Abegunrin 2003). Paragraph 180 of the plan urged member states of the African Union to spend at least 1% of their GDP on scientific and technological capabilities (Organization of African Unity 1980).

The White Paper on Science and Technology introduced by the Department of Arts, Culture, Science and Technology (1996) recognized the need for government to play an enabling role in the encouragement of innovation culture within the private sector. According to Walwyn (2008), a high business expenditure on research and development (BERD) is fundamental for the transition of the South African economy from resource dependency to a knowledge-based economy. This is critical if firms in the country are to match their global counterparts within the new global economy.

1.3 Problem statement

1.3.1 *Focus of the study*

The objective of this research study is to investigate the impact of R&D tax incentives at firm level R&D expenditures and investments. Of particular interest, is whether or not and, to what extent the R&D tax incentive programme has led to additionality in R&D expenditure and greater relevance in R&D strategies. The research also seeks to identify barriers and constraints facing the R&D tax incentive programme and to make recommendations for improvements.

1.3.2 *Research questions*

The first research question is to determine whether or not firms perceive R&D tax incentives to provide benefits in terms of improved cash flows and enhanced competitiveness.

The second research question seeks to ascertain whether or not R&D tax

incentive beneficiaries subsequently undertake any changes in their R&D investment patterns.

The third research question explores inhibiting factors that limit the usage of the R&D tax incentive and its usefulness in terms of innovation objectives.

1.4 Significance of the study

The findings from this study are vital for both policy makers and firms. There are no formal empirical findings in literature on the subject since the implementation of R&D tax incentive in South Africa. Therefore this study provides a basis for new research from which expanded investigations and formal evaluations can follow. The study documents successes and pitfalls of the programme and can be used to answer important questions. Policy makers can use the results to judge whether the tax forgone is justifiable in light of the benefits derived on successful implementation of the scheme, while executives in the private sector may be better able to align firms' R&D objectives with those of government's desired outcomes.

1.5 Delimitations of the study

R&D is widely known for inheriting some characteristics of a public good. Studies in this area tend to attempt measuring the social rate of return and private rate of return from investment in R&D. This study does not attempt to cover the impact of R&D tax incentive on the social rate of return.

With the small sample size used, the study is intended to be exploratory in nature to give a broad picture regarding the impact of R&D tax incentive. The outcome of this research is not intended to give a conclusive picture but rather to unpack the uncertainty and vagueness of the policy impact.

1.6 Assumptions

The following assumptions are made regarding the study:

- The sample is aware of the impact of R&D tax incentive within their firms due to their seniority within the organization. Lack of such awareness would negatively affect the credibility of the study.

- The results from the three provinces (Gauteng, Western Cape and KwaZulu Natal) where the data was collected well represent other provinces. If the opposite were to be true, it could lead to incorrect conclusions being made regarding the impact on other provinces in which representatives were not interviewed.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The literature review focuses on variations of R&D tax incentives; its impact on R&D investment and innovation; the impact on R&D location through the measure of effective tax rate; the South African innovation system; and R&D strategies within high R&D intensive firms.

In addition, this section reviews the practices in monitoring and evaluation (M&E) of R&D tax incentives and on the generally agreed tangible impacts of this policy instrument. This section also identifies the gap in the literature regarding the impact of this policy instrument. According to Kusek and Rist (2004), M&E is a powerful public policy tool that can be used to improve the way the governments and organizations achieve results. Lastly, the firms' situation is considered in so far as it might support or inhibit firms from benefiting from a R&D tax incentive scheme.

2.2 R&D tax incentives

There are different types of R&D tax incentives in various countries across the globe. The main categorizations are those that incentivise capital R&D expenditure and those that focus on current R&D expenditure. Governments of these countries choose a combination of such R&D tax incentive formations to address the unique challenges facing their countries.

R&D tax incentives, owing to their indirect nature, differ from direct government R&D grants in the sense that they assume that the private sector is better suited to determine the amount and type of R&D that it should undertake (Lalonde 1983). This assumption, according to Lalonde, results from the fact that any firm's R&D projects has to make business sense, in other words, the results need to be marketable and the projects need to be profitable.

With this open economy model regarding R&D tax incentive, governments are

able to influence the intensity and nature of R&D in their countries by varying the tax structure of R&D performing companies. Accelerated depreciation is a widely used tax benefit in many countries as it reduces burden for companies by freeing cash flow quickly which is tied to the R&D assets.

According to Auerbach (1982), the shifting of deductions towards earlier years is equivalent to an interest-free loan from the Treasury, as it allows the purchaser of the asset to defer tax payments to later years without an increase in the amount due. This is more useful for small, medium and micro enterprises that need sufficient cash for growth.

R&D tax incentives for current expenses are mainly in the form of R&D tax deductions and credits. R&D tax deduction, as the name implies, allows for super-deduction of R&D expenses by a certain percentage above actual R&D expenditure. This as a result decreases the taxable income of the firm, resulting in less tax being payable.

The thorough examination of R&D tax incentives publications shows dominance by R&D tax credits. R&D tax credit, as opposed to R&D tax deduction, calculates R&D tax benefit as a certain percentage of R&D expenditure. Unfortunately, there is a scarcity of studies on the advantage of tax credits over tax deductions, although it is a fact that tax deductions are influenced by factors such as sufficient revenue and taxable income. Tax credit, on the other hand, takes into account only the level of expenditure of the expense category that is being incentivised.

R&D tax credits, as is the case with R&D tax deductions, are implemented in various forms in different countries or even within different regions in the same country. The most common variation is with regard to the provision of high credit for incremental R&D expenditure as compared with R&D expenditure in a particular pre-determined base year. Other countries attract foreign direct investment and also technology transfer through enhanced R&D tax credit. Special R&D tax credit is also used to promote the distribution of R&D costs among labour, equipment, consultants, and overheads, among other things.

Other countries influence the nature of the R&D conducted by giving special R&D tax credit to certain sectors of the economy, such as pharmaceuticals or SMMEs. The United States Orphan Drug Act of 1983 paved the way for the creation of a set of incentives such as 50% special R&D tax credit on clinical development expenses for firms that develop drugs for rare conditions (Grabowski 2003).

Another variation of R&D tax credit is with regard to refundable and non-refundable tax credits. According to MacDonald (2003) the significance of R&D tax credit being refundable is that the receipt of the tax benefit is not dependent on the existence of tax liabilities, whereas non-refundable credit is dependent on tax liabilities. As a result, refundable R&D tax credits can result with negative tax liability while non-refundable R&D tax credits can only reduce tax liability to zero.

2.3 R&D tax incentives impact on innovation

According to Cefis and Marsili (2006), investment by companies in innovation and R&D, actively accelerate their learning, although on the other hand it creates uncertainty of results and endogenous asymmetries among firms. This leads to less profitable firms exiting the market. It has been proven that a higher rate of innovation in a sector leads to a high exit rate of firms.

The second challenge with regard to R&D is its nature of being perceived as a public good. The investment by a company in R&D is not only uncertain in terms of R&D output, but this output is not guaranteed to be solely owned by the company. This alludes to the term- social rate of return from R&D. As noted by Bernstein and Nadiri (1988), the R&D investment by a company reduces its own production costs, and as a result of spillovers, it also reduces the costs of other firms.

These types of market failures led to different governments around the world implementing various R&D tax incentives to stimulate R&D and innovation in their countries. Mansfield (1986) studied the effectiveness of R&D tax credit in the United States, Canada and Sweden. As is the case with the findings of

similar studies by other researchers, the results were inspiring, showing an increase in R&D expenditure of an average of 1% for these three countries as a result of R&D tax credit. In addition, the ratio of the tax incentive induced increase in R&D spending to the forgone government revenue, was generally in the region of 0.3 to 0.4.

A similar study conducted by Bloom, Griffith and van Reenen (2002) found evidence that tax incentives are effective in increasing R&D intensity. The authors estimated that a 10% fall in the cost of R&D due to R&D tax incentives stimulates just over a 1% rise in the level of R&D in a short-run, and just below a 10% rise in a long-run.

The impact of R&D tax incentives on the innovativeness of various countries is not straight forward as there is a lot of complexity and uncertainty around the policy. The US for example has been extending its R&D tax credit since 1981 without making it permanent. One of the reasons for not making R&D tax credit permanent in the US, according to McCutchen (1993), is that Congress needs time and more information to evaluate the effectiveness of R&D tax credit.

Tassey (2007) investigated the ideal R&D tax credit structure suitable to have a great impact on innovation. R&D tax credit's scope of coverage, the ability of the industry to take full advantage of it in their R&D cycles, the magnitude of incentive relative to other nations' fiscal policies, and its ease of implementation were identified as some of the successful factors.

R&D tax incentive's impact on the nature of research is an interesting research area as it is a known phenomenon that basic research is more neglected by the private sector. Atkinson (2007) noted that earlier stage research is riskier and the benefits are harder to capture fully by the company; this prompts the need for generous R&D tax incentives for basic and earlier stage research.

2.4 Effective tax rate impact on R&D location

At a microeconomic level, as noticed by Sprague (2008), tax planning has become a tool for business strategy. Within the same industry it is found that

companies may have different Effective Tax Rates (ETR), giving the additional opportunity to tax managers of firms for effective tax planning to reduce ETR. Section 11D of the Income Tax Act is another method used by innovative firms to try to reduce their ETR.

Prior to the introduction of R&D tax incentive, it is contained in the NRDS that companies operating in South Africa had an average After Tax Cost (ATC) on R&D of 63 cents per each rand spent on R&D (Department of Science and Technology 2002). This was less competitive on a global scale meaning multinational firms had little chance of deciding to locate their R&D centres in South Africa. The tax rate in South Africa has since decreased from 37.8% to 29% and, taking into account the 150% deduction and accelerated depreciation of 50:30:20, the new ATC of R&D is 58 cents for each rand spent on R&D with the B-index of 0.82 down from 1.01 prior to the introduction of R&D tax incentive intervention policy.

ETC can be expressed in different ways and one such method is Total Tax Index (TTI) which is computed by combining primary, secondary and statutory labour costs taxes, and expressing the result as a percentage of total tax paid by companies in the USA. KPMG (2010) ranked countries' TTI for R&D operations and the results indicated a significantly low TTI for some countries such as Australia, Canada, the United Kingdom and the Netherlands. R&D tax incentives are credited for such low TTI, making these countries some of the favourite locations for conducting R&D.

Although firms can plan their tax effectively with R&D tax incentive by achieving industry competitive ETR and low ATC on R&D, an important question of interest to the government is what happens to the additional cash flow that companies gain as a result of such benefits. Is the cash being reinvested within the R&D budget to expand on research activities, to hire more researchers, to buy more equipment, and to conduct advanced pilot tests, or simply to declare better dividends and pay good bonuses for R&D staff?

It is a known principle in business that high return is associated with high risk. In applying for tax incentives by firms, the origin of risks associated with such

benefits of reduced ATC of R&D can be summarized in three categories, viz.: regulatory risk, segmented strategy risk and tax technical risk. According to Neubig and Sangha (2004), regulatory risk emerges as a result of an increased intensity of audits and review by taxation authorities, which may challenge the validity of a firm's tax position.

Segmented strategy risk, as the name suggests, results from situations in which various stakeholders create tax positions in a firm without clear coordination by the tax department of the company. Lastly, tax technical risk is viewed as tax risk emanating from the potential uncertainty in the interpretation of tax laws by tax authorities. SARS interpretation note 50 on section 11D, has been under constant attack from tax practitioners and innovation experts in terms of tax technical risk with regard to its recently released Interpretation Note on Section 11D.

Examples of such critics are Timm (2009), Margo (2009) and Jooste (2009). The common point of concern is on the exclusion of software for internal business processes, which, as interpreted, would exclude big industry players in information technology from claiming the R&D tax incentive. SARS is also accused of not using an internationally acceptable definition of R&D such as that from the Frascati manual.

Figure 1 shows different risk with same expected return of tax positions A and B which might discourage more risk-averse companies from taking advantage of R&D tax incentives in South Africa.

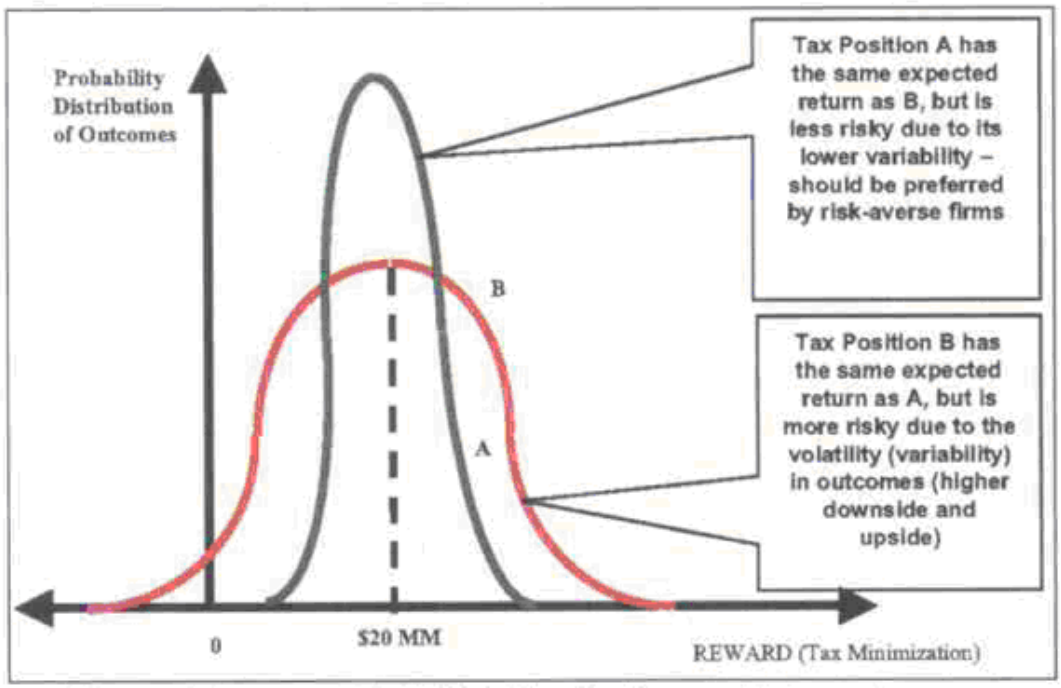

Figure 1: Low and High Risk Tax Positions with Same Return (Neubig and Sangha 2004: 116)

2.5 South African innovation system

The description and characterization of the national innovation system entails various elements such as innovation, local system of innovation and regional system of innovation. According to de la Mothe and Paquet (1998) local and regional systems of innovation are special configurations that have emerged as covenants of identity and as frameworks for belonging and learning. The authors conclude that the three basic processes which underpin innovation are: learning, proximity and coordination.

Innovation is widely known in terms of idea generation and implementation. Such ideas can come from R&D or can be sourced from local and/ or international partners. The common classification of innovation is also in terms of open and closed innovation. The traditional closed innovation is characterised by a high level of secrecy regarding R&D activities at firm level such that their results limited R&D collaborations as shown in Figure 2. Companies A and B develop their technologies in isolation although they are targeted at the same market; this is often characterized by duplication of R&D

efforts and competition for scarce resources.

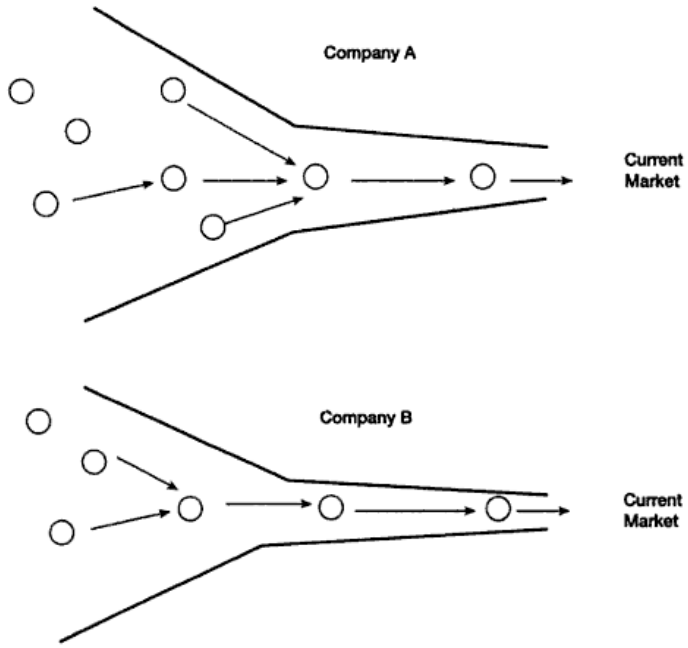

Figure 2: The Knowledge Landscape in Closed Innovation (Chesbrough 2006: 31)

Open innovation is what inspires the concept of an innovation system in which innovation is approached at a systematic level in which various role players work together in achieving a shared objective.

There are various initiatives in South Africa that are aimed at strengthening the local, regional and national systems of innovation. Examples of these are the South African Innovation Network (SAINe); rapid appraisal of local innovation systems tool by the South African Local Economic Development (LED) Network; COFISA (Finland and SA governments programme to strengthen SA system of innovation); the planned North West Science Park; The Cape IT Initiative; Innovation Hub; Capricorn Business and Technology Park; Technopark; and the annual South African Innovation Summit.

The innovativeness of companies in South Africa is influenced by a number of factors, some which are positive and others negative. The recent study conducted by Mayer (2010) looked into external and internal factors that affect innovation in South Africa. Figure 3 shows the perceived levels of external

factors impacting on the innovation landscape of South Africa.

Please rate the impact of the following external business landscape factors on SA innovation efforts.				
	Negative impact	No impact	Positive impact	I don't know
SA geographical location	34%	23%	39%	4%
SA political landscape	68%	13%	17%	3%
National innovation initiatives e.g. CPSI	13%	32%	43%	13%
Government programmes support innovation	18%	33%	41%	8%
Technology access e.g. Broadband	48%	15%	36%	0%
National innovation rewards	19%	41%	30%	10%

Figure 3: External Business Factors Impacting on Innovation in SA (Mayer 2010)

National innovation initiatives, government programmers that support innovation and South African geographical location are mentioned as dominant positive factors in support of the South African business sector's innovativeness. The South African political landscape and technology access are perceived as the dominant negative factors negating business sector innovation.

The author also explored internal business landscape factors affecting South African innovation efforts as shown in Figure 4. On the contrary, all internal factors are perceived to impact positively on South African business sector innovativeness. Leadership and suitable infrastructure are rated higher.

Please rate the impact of the following internal business landscape factors on SA innovation efforts.				
	Negative impact	No impact	Positive impact	I don't know
Leadership	21%	11%	65%	3%
Availability of funding	46%	6%	47%	1%
Suitable infrastructure	28%	10%	61%	1%
Availability of skills	33%	11%	55%	1%
Private and public sector collaboration	21%	25%	45%	8%

Figure 4: Internal Business Factors Impacting on Innovation in SA (Mayer 2010)

It is encouraging to note the higher rating for government programmes that support innovation in South Africa. A well -known government programme is the Industrial Development Corporation (IDC) that helped to fund the establishment of most innovative companies in South Africa. The Small Enterprise Development Agency (SEDA) has a Technology Programme aimed at assisting

SMMEs with technology access and efficiency.

The Technology Innovation Agency (TIA), which was established recently, assists South African companies with challenges such as funding of innovative ideas, IP protection, incubation, and the fostering of collaborations, among others. Other recognised programmes are the Support Programme for Industrial Innovation (SPII), and the Technology and Human Resources for Industry Programme.

2.6 Dominating R&D strategies within firms

Just like the functional strategy of any company, R&D strategy is created in line with the corporate strategy of the company. There are different strategies that firms adopt in order to compete in the market place. As Roussel, Saad and Erickson (1991) assert, the management of research and development must be purposeful rather than hopeful or 'hands-off', and must always be connected with the firm's overall business strategy.

The most common generic competitive strategies are differentiation and low cost positions (Karnani 1984). A company competing through differentiation is expected to have higher R&D intensity than a company specialising in commodity products.

Liao and Greenfield (1997) explored the impact of generic competitive strategies on corporate R&D in Japanese technology-based companies and found that both differentiation and cost leadership have considerable impact on corporate R&D. The main finding for the study is the importance of consistency in a firm's competitive strategy for R&D management.

In a market dominated by commodity products, there is not much opportunity for product improvement and hence much of the R&D and innovation are concentrated towards the process research, with the goal of achieving efficiency and process effectiveness. In such circumstances, companies with good market

outcome are those that are able to lower their inputs transformation cost, with a possibility of increasing their profit margins or passing the cost saving to their customers.

Another element of corporate R&D strategic choice relates to the extent of governance and control within the company between the management and the board. There are several studies that have looked into this relationship and one such study by Baysinger and Hoskisson (1990) reported a significant negative relation between outside-director (board member) dominance and the intensity of research and development. The authors suggest that better results would be expected if outsiders acted as guardians of the stockholders' welfare in a research-intensive environment rather than exerting too much control, which should instead be left with the management.

Figure 5 shows the three types of market failures experienced by R&D performing companies, discouraging management's investment in R&D. For each type of market failure (general risk, R&D-specific risk and market-related risk), Tassey (2006) suggests the type of policy response that can be adopted.

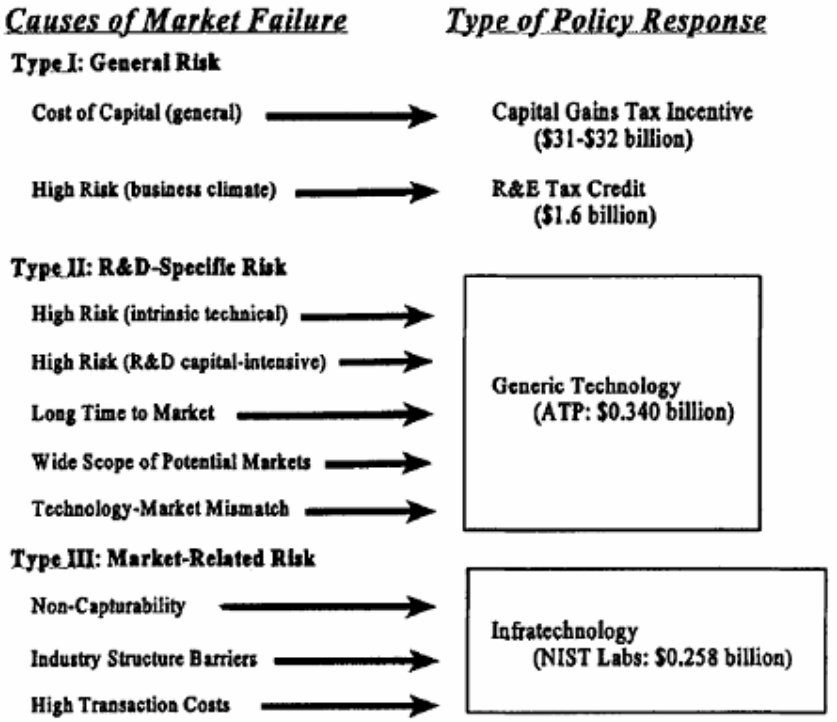

Figure 5: Market Failure on R&D Investment (Tassey 2006: 586)

South African companies experience different types of market failure in terms of R&D investment. Most of the middle managers' inability to be proactive in managing the changing market needs in terms of products and processes is well documented by Barnes, Bessant, Dunne and Morris (2001). This study discovered that many middle managers in South Africa failed to adequately equate market pressures facing their firm with the need to reorganize production to better meet these demands and maximise value-creation potential.

2.7 R&D tax incentives in other countries

The popularity of R&D tax incentives across the world has seen movement towards an era in which they are used as a competitive and strategic tool for countries seeking to gain global competitiveness. In general, the R&D incentives are provided across the world in a variety of tax deduction, enhanced deductions, tax credit, R&D property investment, R&D grants and other incentives (KPMG 2009). According to the KPMG report, in the Asian Pacific region most of the countries provide R&D tax deduction. Japan, New Zealand, South Korea and Taiwan provide R&D tax credit, while numerous other countries provide enhanced deductions.

Australia, as an example, prior to the 2010 tax year had, in addition to its 125% R&D deduction, the 175% deduction for positive incremental increase in R&D expenditure. China attracts foreign R&D investors by 150% deduction for foreign firms, provided that their R&D expenditure increased by 10% from the previous year. According to OECD (2002), increasing member countries use tax instruments to encourage firms to increase their R&D expenditure. Nonetheless, some OECD member countries such as Finland and Sweden neither subsidise nor extend preferential tax treatment to business R&D although these countries have high levels of private R&D expenditures.

2.8 R&D tax incentives and evaluation techniques

Various papers have been published across the globe with regard to R&D tax incentives' impact evaluation. The evaluation techniques vary among different researchers. Techniques suggested by CREST (2006) are event studies; case studies and surveys; and econometric studies. In strategy terminology, event studies consider R&D tax incentive as an event that takes companies by surprise when the before and after studies are conducted. Comparison is made thereafter.

The measurable in such cases can be the change in market value of firms or the change in R&D expenditures. The selection bias of firms is highly possible as there may be characteristic differences between benefited and non-benefited firms. Czarnitzki, Hanel and Rosa (2004) mention the use of various correction methods such as the difference-in-difference estimator, control function approaches, IV estimation and non-parametric matching.

Berger (1993) used regulatory event study by examining both firms estimated to receive R&D tax credits and firms estimated to receive no credits. The study showed increased spending by firms benefiting from such credit by $1.74 of R&D expenditure for each dollar forgone by Treasury in tax collection. On the contrary, the R&D tax incentive, in most cases is not an event as several prior and prolonged discussions take place before its implementation. As noted also by Hall and Reenen (1999) event studies (case study as part of) typically rely on the assumption that the event being studied is a surprise to the economic agents it affects.

There are several studies using econometric models to evaluate the effectiveness of R&D tax incentives. Such techniques have yielded rich information on tax incentives, such as the study by van Pottelsberghe, Nysten and Megally (2003) who used the technique to evaluate business R&D fiscal incentives in Belgium.

The pitfall with the econometric models as cautioned by Lucas Jr. (1976), is

derived from the fact that the structure of the model consists of optimal decision rules by economic agents, and that optimal decision rules vary systematically with changes in the structure of series that are relevant to the decision-maker. This implies that any change in policy such as the introduction of R&D tax incentive turns to change the econometric model.

2.9 Behavioural change of firms due to R&D tax incentives

2.9.1 *Additionallity on R&D investments*

The primary goal of R&D tax incentives is to stimulate increased R&D spending by private firms, which is classified as input outcome. Guellec and Van Pottelsberghe (2000) compiled a summary of possible impacts of R&D tax incentives in Figure 6. Their study of 17 OECD member countries on R&D tax incentives' impact over two decades revealed that direct government funding and R&D tax incentives are substitutes for each other. An important finding in this study is the fact that the stimulating effect varies with generosity, increasing up to 13% of BERD, and decreasing thereafter. According to Shah (1995), R&D expenditure relates to projects in the current year while knowledge capital is a result of accumulated R&D expenditure over years, which might explain the observed restriction on R&D expenditure stimulation.

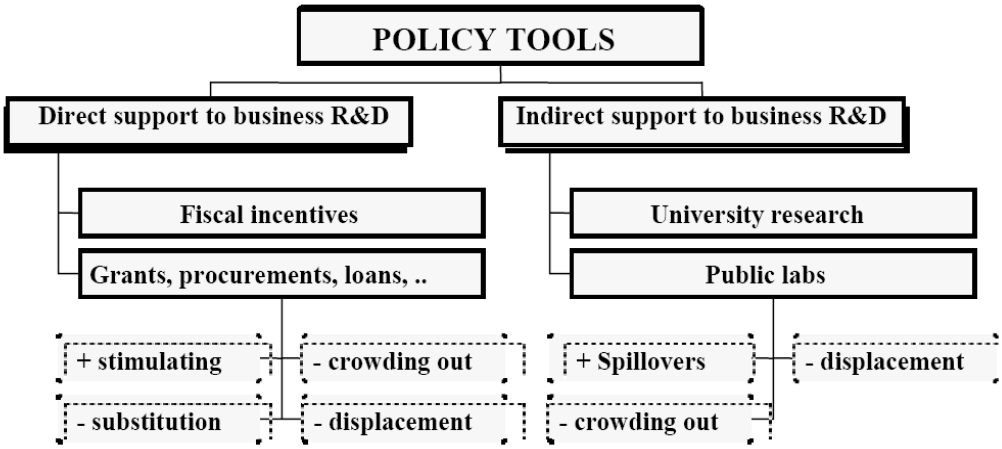

Figure 6: Policy Tools and Potential Effects (dotted lines) on Private R&D Outlays (Guellec and Van Pottelsberghe 2000: 8)

As Figure 6 shows, fiscal incentives have the possibility of stimulating, substituting, crowding-out or displacing private R&D investment. University research and public laboratories (more on defence) tend to have a crowding-out effect on business R&D. This was confirmed by a study on OECD member countries, while several economics studies have investigated influence on private expenditure by government fiscal expenditure assistance. Argy (1979) distinguishes between real and nominal crowding-out on private spending. The real crowding-out results have no effects on R&D expenditures due to fiscal expansion, while nominal crowding-out results have no effects on nominal income. This is explained through supply and demand forces assuming the scarcity of resources and further through the law of diminishing returns.

The crowding-out is easily explained through the work done by Porter (1990) on the competitive advantage of nations. Factor conditions such as skilled labour and infrastructure are mentioned as vital components for global competitiveness. Knowledge has become one of the factors of production in this new knowledge economy (Prusak 1997). Reduced cost of R&D and improved cash-flow of private research laboratories require further complementing factors to realize desired outcomes.

Lim (1983) investigated the impact of tax incentives on foreign direct investment (FDI) on less developed countries (LDCs). The study conducted through the ordinary least squares by expressing foreign direct investment as F, IG as generosity of incentive package, ME as availability of natural resources, ED as the level of economic development and GR as the rate of economic growth with the following equation:

F = f(IG,ME,ED,GR),

It was found that F is positively related to ME and ED while IG is negatively related to ME and ED. This is due to the fact that countries with a low state of economic development will provide more fiscal incentives as a compensating effect. An end result is the statistical inverse relationship of FDI with the generosity of an incentive package. An increase in R&D expenditure by multinational firms in South Africa therefore cannot be deduced only from the

generosity of R&D tax incentive as compared to the rest of the world; other factors also play a role.

Hall (1992) investigated the elasticity of R&D investments in relation to cash-flow on a large panel of US manufacturing firms from 1973 to 1987 and the findings were positive as they revealed positive relation. This was better explained by the fact that firms do not prefer to perform R&D through debt, implying that leverage ratios and R&D investment are negatively correlated. The author further argues that R&D investments cannot only be explained by tax differences.

2.9.2 *Change in competitiveness of beneficiary firms*

Studies on R&D expenditure additionality, as stated before, are considered to be input oriented. On the other hand, output effects are measured by general economic benefits derived by firms as a result of increased R&D activities. The output evaluation is important, especially when one examines the Ten Year Innovation Plan compiled by Department of Science and Technology (2007) which sets a programme of action for the period 2008 - 2018.

Knowledge generation and exploitation (R&D and innovation) are mentioned as some of the drivers in a knowledge-based economy where the plan set out, among other targets, to achieve by 2018 gross expenditure of R&D over GDP of 2%. This is in relation to more than 50% of national income derived from knowledge-based industries, more than 50% of firms using technology to innovate and about 55% of high and medium technology exports/ services as a percentage of all exports/ services. The Ten Year Innovation Plan has sector targeted plans for South Africa, this country being among the top three emerging economies in the global pharmaceutical industry.

To achieve these targets therefore it requires more focused monitoring and evaluation of policy tools such as R&D tax incentives, as noted by Walwyn (2008). Simplification of output evaluation is illustrated in Figure 7 as follows:

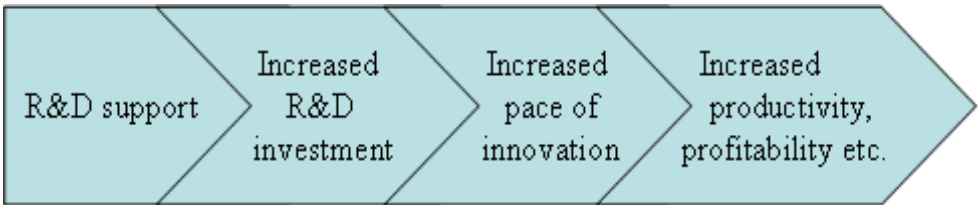

Figure 7: R&D Tax Incentive Impact Model (CREST 2006: 11)

According to MacDonald (1986) this is a linear model in which governments assume that innovation is necessary for economic growth and in which R&D is a necessity for innovation. MacDonald challenges the flaws of the linear model assumption as R&D tend to create more R&D rather than innovation. This claim is based on the 20- year failure of Australian R&D tax credit to bring positive expected outcomes since the date of its launch.

2.10 Relevance of R&D tax incentives with firms' situation

Companywide understanding of the definition of R&D and good documentation of R&D activities, serve as initial prerequisite conditions for companies to take on the benefits of R&D tax incentives.

2.10.1 *Eligible R&D definition*

Prior to the introduction of R&D tax incentives, firms generally had their own understanding of R&D. Within the same firm the definition can also vary. Those companies who participate in the annual R&D survey are familiar with the definition of R&D according to the Frascati manual. This manual, produced by OECD, defines R&D as follows:

> Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications (OECD 2002: 30).

Categories of R&D are divided into basic research, applied research and

experimental development. The Frascati manual excludes activities such as education and training; stand-alone scientific and technological support services (collecting, coding, recording, classifying, disseminating, translating, analysing and evaluating); other industrial activities (such as innovation and production); administration and other supporting activities (e.g. transporting, financing, storage, cleaning, maintenance, security etc.)

The exclusion of innovation activities is critical as R&D is sometimes confused with innovation. OECD has a definition of innovation in the Oslo manual for the purposes of Innovation Survey conducted by several OECD countries and affiliated non-member countries such as South Africa. The Oslo manual defines innovation as:

> the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. (OECD 2005: 46)

The South African definition of R&D for the purpose of claiming on R&D tax incentive is, to a large extent in line with the Frascati manual definition, although there are noticeable deviations. R&D activity by the banking industry is recognised in the Frascati manual although excluded for claim by South African R&D tax incentive. All R&D in Social Sciences and the Humanities is another example of exclusion. The widely criticised exclusion is that of software development for internal business processes, even if it is researched to be developed for clients. Such exclusion is difficult to defend on a benefit-to-cost basis or on the R&D definition merit.

R&D definition is thus very important in terms of compliance by firms and to defuse fears of penalties by tax authorities. Separation of R&D from innovation definition might enable firms to manage R&D and innovation portfolios separately with better focus, leading to the bridging of the Innovation Chasm investigated by Pouris (2008). Innovation Chasm is simply a lack of industrial exploitation of scientific findings leading to technology leakage to other

countries.

2.10.2 *Documentation of R&D activities*

The study commissioned by New Zealand's Ministry of Research, Science and Technology and conducted by KPMG (2008) on selected 121 representative New Zealand firms, investigated the state of R&D documentation by firms. The methodology followed an initial survey followed by a panel discussion on required documentation for the purpose of claiming on R&D tax credit. The second survey on the same set of questions was conducted thereafter.

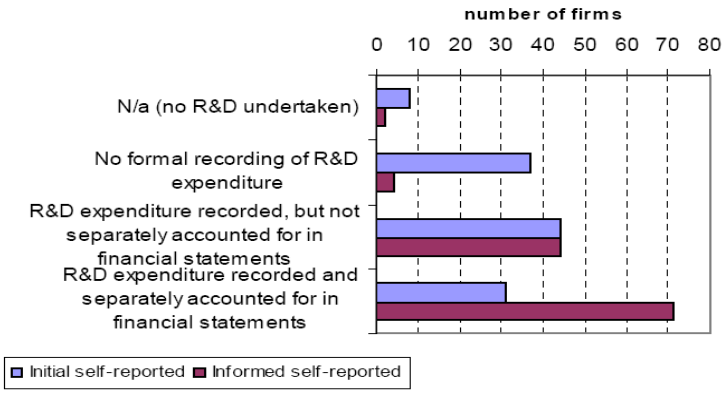

Figure 8: R&D Documentation by Firms (KPMG 2008: 17)

The finding exhibited in Figure 8 is interesting in that it exhibits a lack of sufficient R&D recording in the accounting systems of firms. The shift in the fourth question on separately recording R&D in financial statements shows a difference in understanding of what type of documentation is required by authorities and what firms do document. Poor documentation of R&D can lead to uncertainty of R&D expenditure of the firm and fear of penalties from tax authorities.

A presence of R&D tax incentive therefore can have the impact of challenging firms to improve the documentation of their R&D activities. In the long run this results in a strategic advantage in the agility to capture opportunities provided by R&D within the firm or through research partnerships.

R&D tax incentive also influences the debate on whether R&D costs should be

expensed or capitalized. Firms seeking to make use of this opportunity by default select to expense their operational R&D costs. R&D capitalizers claim that it enables management to better communicate information about the success of projects and their probable future benefits (Oswald and Zarowin 2008).

2.11 Conclusion of Literature Review

The literature review reveals the general disagreement on the impact of R&D tax incentives on private sector R&D investments and the resulting competitiveness of firms. Other factors such as knowledge workers, infrastructure and innovation are identified as being important in realizing the benefits of such fiscal incentives. This policy instrument is considered as vital to reduce the effective tax rate on R&D performing firms and as a result improve cash-flow. This improvement is vital, as firms do not prefer to conduct R&D through debt. Systematic barriers to the use and realization of R&D tax incentive benefits are identified as R&D documentation and definition; and the choice on whether to expense or capitalize R&D.

2.11.1 *Research Question 1:*

What tangible financial and competitiveness benefits do companies derive as a direct consequence of implementing a R&D tax incentive policy?

2.11.2 *Research Question 2:*

What is the pattern in R&D investments change by firms since the introduction of R&D tax incentive in South Africa?

2.11.3 *Research Question 3:*

What are the inhibiting factors preventing companies from taking full advantage of R&D tax incentive?

CHAPTER 3: RESEARCH METHODOLOGY

This chapter describes how qualitative methods were used to conduct this research. Data was collected through interviews with companies that applied for R&D tax incentive in South Africa. These were followed by discussions with subject matter experts. A short description is presented of this technique and its appropriateness for this research, followed by a description of research design, the outline of population and the sample characteristic. Data collection and analysis are described together with issues of validity and reliability for this study.

3.1 Research design

The methodology utilized for this study is qualitative in nature. It involved one-on- one semi-structured interviews in order to answer the above research questions. The semi-structured interview, as widely used in qualitative research, consists of a set of pre-determined open-ended questions with other themes emerging from the interview dialogue (DiCicco-Bloom and Crabtree 2006). This type of research can therefore be considered to be confirmatory as well as exploratory in nature, which is ideal for uncertain new areas such as R&D tax incentive in the context of South Africa. Burck (2005) observes the distinct difference between questions being asked as close-ended and a more flexible semi-structured interview, which is adaptive and allows the interviewee room to elaborate.

A qualitative interview is ideal as R&D tax incentive is a new topic in South Africa that can be explored better based on research questions that are open-ended and exploratory (Burck 2005). The technique is useful in exploring people's lived experiences and perspectives in context (Freeman 2006).

This research design enabled a non-mathematical process of interpreting respondents' data on R&D tax incentives, carried out for the purpose of discovering concepts and relationships with regard to research questions developed, and then organized into a theoretical exploratory scheme as noted

by Strauss and Corbin (1998).

The in-depth interviews used for primary data collection were allocated between 60 and 90 minutes. This allowed for the possibility of emerging themes during the interview. The interviews comprised a form of investigative interviewing that tends to focus mainly on events and processes (Rubin 2005), although a concept clarification format that focuses on meanings and frameworks was also used and incorporated. The research was in the form of one-on-one semi-structured qualitative interviews based on 11 open-ended, narrative-based questions in Appendix A. In some exceptional cases there was an assistant to the interviewee to help with other specialised areas such as R&D activities.

Although there is a clear exploratory advantage to this type of research design, unfortunately it assumes the experienced and skilled interviewee with first-hand experience on the interview content as noted by Rubin. A balanced and accurate picture might not have been achieved with interviewees who are not familiar with the impact of R&D tax incentive within their firms. Initial screening of the interviewees was therefore important.

Primary data collection from firms was supplemented with expert interviews with government representatives and one academic, as well as secondary data such as R&D and innovation-related reports from the Department of Science and Technology. Secondary data, according to Shugan (2002), is regarded by researchers as a signal of external validity for the study.

3.2 Secondary data

The Department of Science and Technology (DST) is required to report annually to parliament on the direct benefits of R&D tax incentive in terms of economic growth, as well as employment and other broader government objectives and the aggregate R&D expenditure by claiming firms LexisNexis (2007). Such an available report was also used to explore the impact of R&D tax incentive in South Africa. In addition, the R&D Surveys and Innovation Survey that are produced by the same department were used. As noted by Szabo and Strang (1997) this method of data collection is cost-effective and

decreases the respondent burden on readily available data.

3.3 Expert interviews

Government officials from DST, SARS and the National Treasury were interviewed in a collaborative, dialogue style session of gathering data, followed by individual session with one academic. The interviewer played the role of co-expert to interrogate certain ideas while leaving enough room for open discussion. These experts' interviews were aimed at identifying the preferred policy, observed policy outcome, policy performance, expected policy outcomes and policy problems.

This format of enquiry as suggested by van Audenhove (2009) is vital, especially considering the fact that experts are responsible for the development, implementation or control of solutions/ strategies/ policies. According to Meyer and Booker (2001) an analyst can use experts' information to make inferences where data does not exist or where data is sparse.

3.4 Procedure for data collection

Appointments were made with the Financial Directors of identified companies to conduct one-on-one interviews at a place and time of their convenience. The interview questions were provided before the interview to allow gathering of necessary information that the Financial Director might not have had readily available had it not been for the pre-viewing of questions. This was important to allow depth of answers and company-wide perspective. The recording, where possible, was done both digitally and on paper.

3.4.1 Population and sample

The population is made up of all companies that have applied for R&D tax incentive since its launch on 02 November 2006 in South Africa.

The study used a purposive convenient sampling method in an attempt to

match the sample characteristic as closely as possible to that of the population while keeping the research costs low.

The sample was composed of Financial Directors (or nominated representatives) of 20 selected companies which applied for R&D tax incentive. They were chosen based on their knowledge of tax management and a R&D tax incentive claim by their companies. The companies represent Gauteng, the Western Cape and KwaZulu Natal, which are dominant provinces in terms of R&D activity based on the series of R&D surveys being produced yearly by the Department of Science and Technology.

The balance was achieved by sampling large firms along with the SMMEs. Care was taken to ensure representation from the three sectors of the economy. Multinational corporations and South African companies might experience the incentive differently, hence the sampling method attempted to represent both. Post-stratification was used to show results in different segments of the population. According to Smith (1983), for most non-random sampling, post-stratification is employed as a method for making descriptive inferences to a specific population.

Due to the secrecy requirements of the Income Tax Act, the names for the private sector companies and their respondents interviewed were withheld. In Table 1, companies are represented instead by numerical identities and the title of the person interviewed is shown instead of the name.

Table 1: Profile of respondents

Company ID	Size	Sector	Province	MNC	Person Interviewed
1	Large	Secondary	Gauteng	No	Tax Manager
2	Large	Primary	Gauteng	Yes	Corporate Tax Manager
3	SMME	Tertiary	Gauteng	No	CEO & CFO
4	Large	Primary	Gauteng	Yes	FM and R&D Manager
5	SMME	Secondary	Western Cape	No	Managing Director
6	Large	Secondary	Western Cape	No	Financial Executive
7	Large	Primary	Western Cape	Yes	Financial Manager
8	SMME	Primary	Western Cape	No	Financial Manager
9	Large	Secondary	KZN	Yes	FM and R&D Manager
10	Large	Primary	KZN	No	Corporate Financial Manager
11	SMME	Tertiary	KZN	Yes	Director
12	SMME	Tertiary	KZN	No	Sales Manager

Pretoria University	-	Academic	Gauteng	-	Prof. A. Pouris
DST	-	Government	Gauteng	-	Godfrey Mashamba
DST	-	Government	Gauteng	-	Dimakatso Mokone
DST	-	Government	Gauteng	-	Pamella Madula
National Treasury	-	Government	Gauteng	-	Basil Maseko
National Treasury	-	Government	Gauteng	-	Witness Simbanegavi
National Treasury	-	Government	Gauteng	-	Londiwe Khoza
SARS	-	Government	Gauteng	-	Manini Madisha
SARS	-	Government	Gauteng	-	Johannes Mallela

In Table 1, approximately twelve companies from three provinces were interviewed as opposed to the twenty companies initially planned for. This represents a 60% response rate. There were no non-responses from both KwaZulu Natal and Western Cape provinces. Due to non-responses in Gauteng, only seven out of the eleven initially targeted large companies were interviewed. The non-responses are as a result of unavailability of companies' representatives to be interviewed either due to time unavailability or lack of willingness to participate in this research.

There was difficulty in contacting Financial Managers/ Directors of the SMMEs hence a different strategy was adopted to contact the most senior managers, such as the CEO's, for such companies. As a result, 5 SMMEs were interviewed as compared to the 9 initially planned for. All three sectors of the economy were covered, viz.: primary (5), secondary (4) and tertiary sectors (3).

The number of multinational corporations interviewed was 5 as opposed to the 3 contained in the research plan. The source of increase, resulted as the ownership profile of some companies changed from what it was believed to be prior to the interviews. One SMME has headquarters overseas.

3.5 Data analysis and interpretation

The data analysis was carried out through an initial summary of transcripts and voice recordings in text form. This formed part of content analysis which

according to Patton (2002) refers to any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings. The product of content analysis was pattern coding as suggested by Miles and Huberman (1984). Pattern coding according to the authors is a way of grouping summaries into a smaller number of sets, themes or constructs.

The relationship between emerging themes, secondary data and experts' views is illustrated and interpreted through fuzzy cognitive maps (FCMs) to show causal links among themes. The graph structure of these maps according to Kosko (1986) enables systematic causal propagation through forward and backward chaining; and allows knowledge bases to be grown by connecting different FCMs. There are two limitations of FCMs, which are both inherent to the methodology, that limit the linking possibilities (Kok 2009).

The semi-quantified causal relationships obstruct any interpretation in absolute terms. Secondly, timescale is not taken into account with regard to these maps although processes and events take place in different timescales. Nonetheless, their usage is not meant to quantify the problem accurately but they are useful in their own right in simplifying the complexity of the system under study.

3.6 Limitations of the study

The study only covered companies from three provinces in South Africa. The results might not reflect the impact experienced by minority companies operating in other centres and/or underdeveloped areas of the country. A qualitative interview is largely influenced by the researcher and care needed to be taken in order to be consistent and neutral with the respondents.

3.7 Validity and reliability

3.7.1 External validity

The transferability of any study is important for inference purposes of research

findings to the overall population. External validity, according to Malterud (2001), refers to the range and limitations for application of the study findings, beyond the context in which the study was done. This study was only conducted in three provinces of South Africa which raises external validity concerns. Nonetheless, according to the recent 2006/07 R&D survey by the Department of Science and Technology (2009a), R&D expenditure by private firms in Gauteng, Western Cape and KwaZulu Natal contributes to 85% of total business R&D expenditure. The stratified nature of the sample attempts to address bias in sample selection and hence issues of validity.

3.7.2 Internal validity

Internal validity refers to the extent to which scientific observations and measurements are an authentic representation of some reality (LeCompte and Goetz 1982). The major issues that ought to be given attention with regard to internal validity for this study were consistency of the interview structure, familiarity of each respondent to the impact of R&D tax incentive within their companies and common understanding of basic terminologies used during the interview. The sending of a question list to each respondent prior to the interview enabled enough preparation for an accurate reflection of a companywide perspective.

3.7.3 Reliability

Reliability for this type of qualitative research is important for assurance of stability and quality of data collected such that the next researcher can draw on the findings, interpretation and claims of the study (Silverman 2006). According to Campbell (1997), data in qualitative research is open to misinterpretation based on cultural differences. The researcher was flexible in allowing new information to emerge out of interviews and during data reduction; and to not be influenced by pre-conceived concepts and experiences.

CHAPTER 4: PRESENTATION OF RESULTS

4.1 Introduction

This section presents the results in relation to the three research questions for this study, viz.: financial and competitiveness benefit; change in R&D investment pattern; and the inhibiting factors. The results are presented for the qualitative interview of companies and industry experts, followed by secondary data. Fuzzy cognitive maps summarize the results for different groupings of the population.

4.2 Company's interview

This section will show the result of one-on-one qualitative interviews with the companies. For each research question, firm level data is presented followed by segmental data.

4.2.1 Financial and competitiveness benefit

Table 2 shows the change in financial position for the beneficiary companies in terms of a shift in cash position and the change in competitiveness in terms of both local and international competitiveness.

Table 2: Financial and competitiveness change

Company ID	Cash Position	Local Competitiveness	International Competitiveness
1	Anticipating	Own Increase	Not Yet
2	Improved	Not Yet	Not Yet
3	Improved	Increased	Increased
4	Improved	Own Increase	Own Increase
5	Anticipating	Increased	Increased
6	Improved	Increased	Increased
7	Improved	Own Increase	Own Increase
8	No Effect	Not Yet	Not Yet
9	Improved	Own Increase	Own Increase
10	Anticipating	Increased	Increased
11	Improved	Increased	Increased
12	Improved	Increased	Not Yet

Overall	**Improved**	**Increased**	**Increased**

In Table 3, the data from individual companies in Table 2 is categorised in terms of different sample strata by considering a dominating pattern in terms of the highest count. For large companies as an example, there were five companies that reported improved cash position while two of them reported that they are anticipating the improved cash position in future. The dominant pattern is hence an improvement in cash position.

Where there are two equal dominating patterns, they both appear in a cell: for the local companies, for instance, when three companies reported improved cash position, three companies reported anticipation of improved cash position while there was no effect reported by one local company. Both improved and anticipation of improved cash position dominated. The same method of classification will apply for the remainder of this chapter.

Table 3: Segmental financial and competitiveness change

	Cash Position	**Local Competitiveness**	**International Competitiveness**
Large companies	Improved	Own Increase	Own Increase
SMMEs	Improved	Increased	Increased
Primary Sector	Improved	Own Increase/ Not Yet	Own Increase/ Not Yet
Secondary Sector	Anticipating/ Improved	Increased/ Own Increase	Increased
Tertiary Sector	Improved	Increased	Increased
Local Companies	Anticipating/ Improved	Increased	Increased
MNC	Improved	Own Increase	Own Increase
Gauteng	Improved	Own Increase	Not Yet
Western Cape	Improved	Increased	Increased
KwaZulu Natal	Improved	Increased	Increased

4.2.2 R&D investment pattern change

Table 4 shows the results regarding the change in R&D investment in terms of the change in R&D expenditure and R&D costs; the sources of innovation; and other factors that influence the decision to conduct R&D. Innovation sources are further categorised in terms of technology supply and market demand factors.

Other factors that influence R&D investment decision are categorised in terms of positive and negative factors.

Table 4: Change in R&D investment

Company ID	R&D Expenditure	Other Investment Factors	R&D Costs	Innovation Sources
1	No Effect	**Positive**: Competition, Continuous Improvement, Statutory Compliance **Negative**: Labour Supply, Failure Fear	Increased	**Supply Factors**: International **Demand Factors**: Market Needs, Competitor Action
2	No Effect	**Positive**: Continuous Improvement, Statutory Compliance **Negative**: IPR Act	Normal Inflation	**Supply Factors**: Technology Change, Graduates, Innovation Program, Postgraduate Research Projects, **Demand Factors**: Competitor Action
3	Motivated Spending	**Positive:** Technology Driven, Competition, Continuous Improvement	Increased	**Supply Factors**: Engineering Skills **Demand Factors**: Market Needs
4	Motivated Spending	**Positive**: Market Demand, SPII Funding	Normal Inflation	**Supply Factors**: All Labour, University Collaboration **Demand Factors**: Market Needs, Competitor Action
5	Increased Spending	**Positive**: Market Demand	Normal Inflation	**Supply Factors**: Staff with PhDs, University Collaboration, Science Council Collaboration
6	No Effect	**Negative**: R&D Structure	Normal Inflation	**Supply Factors**: R&D Department, Operations, Innovation Program
7	Decreased Spending	None	Normal Inflation	None
8	Motivated Spending	**Positive**: Market Demand	Normal Inflation	**Supply Factors**: International, Innovation Program **Demand Factors**: Market Needs, Competitor Action
9	Motivated Spending	**Positive**: Diversifying Products	Normal Inflation	**Supply Factors**: Operations
10	Increased Spending	**Positive**: Technology Driven	Normal Inflation	**Supply Factors**: Staff with PhDs, University Collaboration, International
11	Motivated Spending	**Positive**: Continuous Improvement **Negative**: Labour Supply	Normal Inflation	**Supply Factors**: Literature, Conferences **Demand Factors**: Market Needs, Competitor Action

12	No Effect	**Negative**: Cyclic Demand, R&D Structure	Normal Inflation	**Supply Factors**: All Labour
Overall	**Motivated Spending**	**Positive: Continuous Improvement** **Negative: R&D Structure, Labour Supply**	**Normal Inflation**	**Supply Factors: Staff** **Demand Factors: Market Needs, Competitor Action**

In Table 5, the overall segmental change in R&D investment is shown by taking into account the dominating patterns.

Table 5: Segmental change in R&D Investment

	R&D Expenditure	**Other Investment Factors**	**R&D Costs**	**Innovation Sources**
Large companies	No Effect	**Positive**: Market Demand, Continuous Improvement, Statutory Compliance **Negative**: R&D Structure	Normal Inflation	**Supply Factors**: Staff, Innovation Program **Demand Factors**: Competitor Action
SMMEs	Motivated Spending	**Positive**: Continuous Improvement, Technology Driven **Negative**: Labour Supply	Normal Inflation	**Supply Factors**: Staff, University Collaboration **Demand Factors**: Market Needs
Primary Sector	No Effect	**Positive:** Diverse **Negative**: R&D Structure	Normal Inflation	**Supply Factors**: Staff, Innovation Program, Operations **Demand Factors**: Competitor Action
Secondary Sector	Motivated Spending	**Positive**: Market Demand **Negative**: Labour Supply, Fear of Failure	Normal Inflation	**Supply Factors**: Staff, International, University Collaboration **Demand Factors**: Market Needs, Competitor Action
Tertiary Sector	Motivated Spending	**Positive**: Continuous Improvement, Technology Driven **Negative**: Labour Supply	Normal Inflation	**Supply Factors**: Staff **Demand Factors**: Market Needs
Local Companies	Motivated Spending	**Positive**: Continuous Improvement, Statutory Compliance **Negative**: Labour Supply	Normal Inflation	**Supply Factors**: Staff **Demand Factors**: Market Needs
MNC	No Effect	**Positive:** Diverse **Negative**: R&D Structure	Normal Inflation	**Supply Factors**: Staff, Innovation Program **Demand Factors**: Competitor Action
Gauteng	No Effect	**Positive**: Market Demand **Negative**: Diverse	Normal Inflation/ Increased	**Supply Factors**: Staff **Demand Factors**: Market Needs, Competitor Action

Western Cape	Diverse	**Positive**: Market Demand **Negative**: R&D Structure	Normal Inflation	**Supply Factors**: Staff, University Collaboration **Demand Factors**: Market Needs, Competitor Action
KwaZulu Natal	Motivated Spending	**Positive**: Diverse **Negative**: Labour Supply	Normal Inflation	**Supply Factors**: International, University Collaboration **Demand Factors**: Market Needs, Competitor Action

4.2.3 Inhibiting factors

Table 6 shows some of the barriers that inhibit the usage of R&D tax incentive in South Africa. These are a differentiation between R&D and innovation; alignment of the R&D definition between the company and authorities; the alignment of accounting and documentation systems of the companies with the information required for R&D expenditure claim; the inherent risks in claiming for R&D tax incentive; and other barriers that the company might encounter during the claiming process.

Table 6: Inhibiting factors

Company ID	R&D & Innovation	Definition Alignment	Systems Alignment	Other Barriers	Claiming Risks
1	Same	Not Aligned	Future Changes	Convincing Investors	Uncertainty
2	Same	Not Aligned	No Changes	Unclear Legislation	Uncertainty
3	Differentiate	Aligned	No Changes	Convincing Investors	Uncertainty
4	Same	Conservative	Future Changes	None	Uncertainty
5	Same	Aligned	No Changes	Claiming Restrictions	Mitigated
6	Differentiate	Not Aligned	Changed	Unclear Legislation	Uncertainty
7	Differentiate	Aligned	No Changes	None	No Risk.
8	Differentiate	Not Aligned	Future Changes	R&D Unit Structure	Mitigated
9	Differentiate	Not Aligned	No Changes	Claiming Restrictions	Uncertainty
10	Same	Not Aligned	No Changes	Insufficient Revenue	Uncertainty
11	Same	Aligned	No Changes	None	Appetite for Risk
12	Differentiate	Aligned	Changed	None	Mitigated

Overall	Same/ Differentiate	Not Aligned	No Changes	Convincing Investors/ Unclear Legislation/ Claiming Restrictions	Uncertainty

The inhibiting factors' patterns for the claims on R&D tax incentive are categorised in Table 7 in terms of the various sample segments. The term 'diverse' indicates that there was no dominating pattern within the segment - For example, the secondary sector had four companies that were interviewed. These four companies reported different barriers in claiming for R&D tax incentive, viz.: convincing investors, claiming restrictions, structure for R&D unit and none. In this situation therefore there are no dominating patterns and categorization shows diverse other barriers that impact on the ability of secondary sector companies to benefit from the incentive.

Table 7: Inhibiting factors in various segments

	R&D & Innovation	Definition Alignment	Systems Alignment	Other Barriers	Claiming Risks
Large companies	Differentiate	Not Aligned	No Changes	Unclear Legislation/ Claiming Restrictions	Uncertainty
SMMEs	Same	Aligned	No Changes	Convincing Investors/ Insufficient Revenue	Uncertainty
Primary Sector	Differentiate	Not Aligned	No Changes	Unclear Legislation	Uncertainty
Secondary Sector	Same	Not Aligned	Future Changes	Diverse	Uncertainty/ Mitigated
Tertiary Sector	Same	Aligned	No Changes	Diverse	Uncertainty
Local Companies	Same	Aligned	No Changes	Convincing Investors/ Claiming Restrictions	Uncertainty
MNC	Differentiate	Not Aligned	No Changes/ Changed	Unclear Legislation	Uncertainty
Gauteng	Same/ Differentiate	Aligned/ Not Aligned	No Changes	Convincing Investors	Uncertainty

Western Cape	Same/ Differentiate	Aligned	No Changes	Unclear Legislation/ Claiming Restrictions	Uncertainty
KwaZulu Natal	Same/ Differentiate	Not Aligned	No Changes	Diverse	Uncertainty

4.3 Experts' interview

This section provides the findings drawn from expert interviews with an academic and policy makers. The details on the interview protocol used for this aspect of data collection are provided in Appendix A.

4.3.1 Academic respondents

In the opinion of the academic respondent, firms derived indirect R&D funding advantages because R&D decisions tend to be outcome orientated rather than funding dependent. In the view of this expert, firms choose R&D tax incentives because funds gained in this way can easily be transferred to other priority areas and this has an advantage over direct assistance. The respondent believed that both indirect and direct R&D forms of support should be made available.

The academic respondent believed that South Africa selected an R&D tax deduction because it "is better than nothing as it can be improved later". He went on to identify challenges with the current structure particularly in terms of its ability to involve SMME in general and those that do not have sufficient profit to benefit. The absence of pre-registration also creates an uncertainty with regard to claiming for R&D tax incentive as there is no guarantee of allowed R&D deduction.

i. Policy performance and outcomes

There is no recent international comparison of SA in terms of R&D expenditure such as an updated B-index, as the last comparison was done about 10 years ago. From the available information, the programme

is not performing well due to too much bureaucracy by government officials.

ii. R&D tax incentive shortfall

R&D incentives provided by other countries are much better than those in South Africa. Multinational companies do not only consider R&D tax incentive in their R&D investment decisions but in South Africa, the company is penalized if it uses other government grants.

4.3.2 South African government officials

The discussion with government officials took place on 14 September 2010 and centred around the issue of market failure, selection of policy instruments and performance of the incentive programme.

As noted in Chapter 2, page 15, when firms experience market failure it can lead to underinvestment in R&D. As shown, there are different types of market failure and associated risks.

i. Selection of R&D tax incentive

There was agreement from government officials that R&D tax incentives were selected because of high R&D risk as compared to the private rate of return. R&D tax incentives were considered to be efficient because they could be applied across all economic sectors in South Africa rather than being *narrow and focused.*

ii. Operational issues

The government officials interviewed regarded the current R&D tax incentive arrangements as being preliminary and introductory. One responded suggested that the SA government “had to start somewhere without necessarily being on full scale”. In the opinion of government respondents, pre-registration was avoided to enable simplified claiming process and in order to avoid an administrative burden.

The respondents were of the view that there was room for improvement and offered the following suggestion:

- the introduction of specific incentives that address the problems experienced by SMMEs such as lack of funds.

iii. Policy objectives

Respondents suggested that R&D tax incentives were introduced in order to:

- Enhance private sector competitiveness by promoting investment in science, technology and innovation;
- Contribute to long term economic growth, as one of the supply-side measures in South Africa;
- Boost the economy's capacity to grow by encouraging private sector companies to acquire capital assets, labour and technology.

These officials believed that the tax revenue forgone is likely to be offset by the greater tax revenues collected in the future from companies that increased their profits through application of R&D output, and through additional value added tax.

iv. Performance and outcomes

At the time of writing, the Department of Science and Technology had issued its first report (covering 02 November 2006 to the 30 September 2008) on the performance of R&D tax incentive showing 80 firms since the inception of the programme. According to the department's officials, the second report is expected to show drastic uptake in the usage of the incentive.

SARS officials were of the view that there were no problems surrounding the interpretation of the regulation setting out R&D tax incentives. In their

view the rules were clear and permitted firms to qualify spend on R&D. These officials acknowledged that the process was however, not able to provide qualification decisions in real time as would be desired by firms.

The SARS officials welcomed efforts to improve communication between taxpayers and SARS, and recommended use of Advanced Tax Ruling to clarify any uncertainties surrounding interpretations.

Among the government officials, there was no clear consensus view as to which organisation - DST or SARS – should have the responsibility for approving claims for R&D tax incentives.

4.4 Secondary data

The findings of the study benefitted from consulting official documents and research reports relating to science, technology and innovation in South Africa. Data from these sources were also used to improve the external validation of the findings.

4.4.1 Innovation Survey data

The first official South African Innovation Survey of 2005 covered the period 2002-2004 (Blankey and Moses 2009). Table 8 shows the sources of innovation in a selection of sectors. In the absence of a category “primary sector”, mining & quarrying was selected to represent the typical sources of innovation in the primary sector. Manufacturing represents the typical pattern in the secondary sector. Services category represents the typical sources of innovation in the tertiary sector.

Table 8: Sources of innovation in various sectors (%)

	Total	Mining and Quarrying	Manufacturing	Services
Internal Sources	49.3	56.1	54.3	44.9
Market Resources				
Suppliers	24.3	14.0	25.9	23.1
Clients/ Customers	34.5	45.2	43.7	26.2
Competitors	12.6	33.0	15.5	9.7
Consultants	3.9	10.2	6.1	1.8
Universities	5.2	0.0	10.2	1.1
Other External Sources				
Conferences, trade fairs	2.2	0.0	3.6	1.1
Publications	3.8	1.4	5.8	2.2
Professional and industry associations	8.6	2.0	0.8	15.5

Source: (Blankey and Moses 2009)

Table 9 shows the factors that hampered innovation activities in South Africa. This is useful for an external validity check on the other negative factors that influence the investment in R&D and innovation by companies.

Table 9: Factors that hampered innovation activities (%)

	Total	Mining and Quarrying	Manufacturing	Services
Cost Factors				
Lack of internal funds	29.1	10.7	32.4	26.6
Lack of external funds	18.7	7.0	16.3	20.7
High innovation costs	22.8	5.6	15.5	29.3
Skill Shortage	20.4	8.7	15.3	25.1
Market Factors				

Market dominated by established enterprises	23.2	28.6	14.0	30.9
Uncertain demand for goods and services	9.5	4.0	3.3	14.9
Reasons not to Innovate				
No need due to prior innovations	3.0	16.6	0.8	4.7
No need as there is no demand for innovation	0.7	15.4	0.7	0.4

Source: (Blankey and Moses 2009)

4.4.2 R&D Survey

The series of the annual South African R&D Survey has a section dedicated to R&D investment patterns by the business sector. This is relevant to the R&D tax incentive as the incentive is directed towards the private sector. Table 10 shows R&D investment characteristics in the South African business sector from 2004/05 until 2007/08. The R&D Survey has a two– year delay to the date of its publication; hence the only available latest values are for 2007/08.

Table 10: Main characteristics of the business sector

	2007/08	**2006/07**	**2005/06**	**2004/05**
BERD (R' million)	10,739	9,234	8,244	6,766
BERD as % of GDP	0.54%	0.53%	0.54%	0.49%
% of BERD financed by industry	66.4%	69.4%	68.3%	69.0%
% of BERD financed by government	21.7%	19.1%	16.2%	7.1%
% of BERD financed by other national	0.9%	0.9%	1.0%	6.1%
% of BERD financed from abroad	11.0%	10.6%	14.5%	17.9%
Total business sector R&D personnel (FTE)	12,461	12,595	12,236	11,296
Total business sector researchers (FTE)	6,048	6,111	5,896	5,301

Source: (Department of Science and Technology 2009b, 2010)

4.4.3 R&D tax incentive annual report to parliament

The Department of Science and Technology as part of its statutory requirements produces an annual report to parliament regarding the progress of R&D tax incentive. Table 11 shows the summary of the data from the first 2008 report which had only 80 submitted forms. This 80 does not necessarily indicate the number of companies as one company can claim for different financial years at the same time or in the same reporting year.

Table 11: Summary of R&D tax incentive claims

Item	Reported figure
Number of forms received	80
R&D operational expenditure	R681,1m
R&D capital expenditure	R76.9m
Total R&D expenditure	R764.0m
Tax revenue foregone (estimate)	R99.6m
Total R&D personnel involved	1699

Source: (Department of Science and Technology 2009c: 6)

The amount of total R&D expenditure claimed reflects close to 10% of the typical business expenditure in research and development as shown in Table 10. The same trend is observed with regard to the number of R&D personnel in full time equivalence. If the South African government were to offer direct R&D grants instead of the indirect R&D tax incentives, the total value of grants would be R99.6 million, being equated to the tax revenue forgone.

Figure 9 shows the percentage R&D expenditures by participating companies in different fields of science as defined by South African Council for Natural Scientific Professions (SACNASP). Companies conducting Chemical Science research benefited on 56.0% of the R&D tax incentive, followed by Industrial Science (23.5%) and Mathematical/ Computer Science (5.1%).

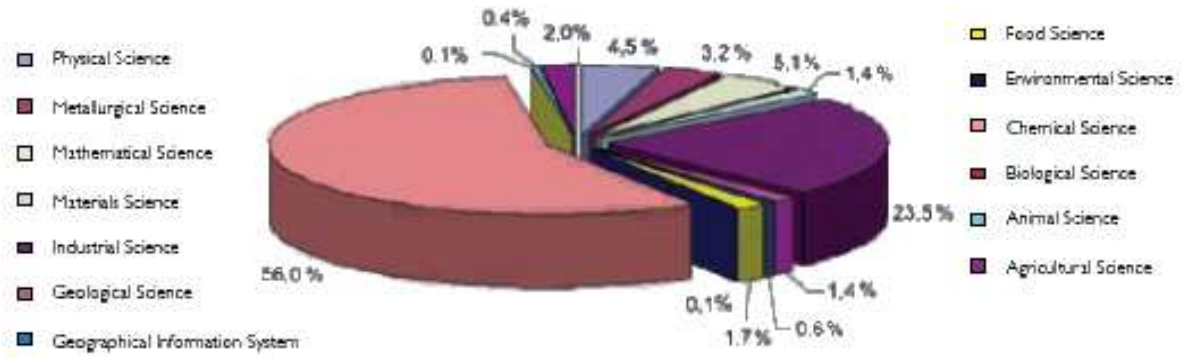

Figure 9: Percentage R&D Expenditure by Field of Science (Department of Science and Technology 2009c: 6)

4.5 Fuzzy cognitive map of impact patterns

The results are summarized in Figure 10 through a fuzzy cognitive map to aid visualization of the overall impact pattern by the R&D tax incentive policy instrument. The positive sign indicates positive impact while the negative sign indicates the opposite. The entries in the rectangular box represent policy nodes. The dotted lines between R&D and innovation indicate that some of the companies do not differentiate between R&D and innovation. The connecting lines are not necessarily in scale in terms of the intensity of impact and timescale.

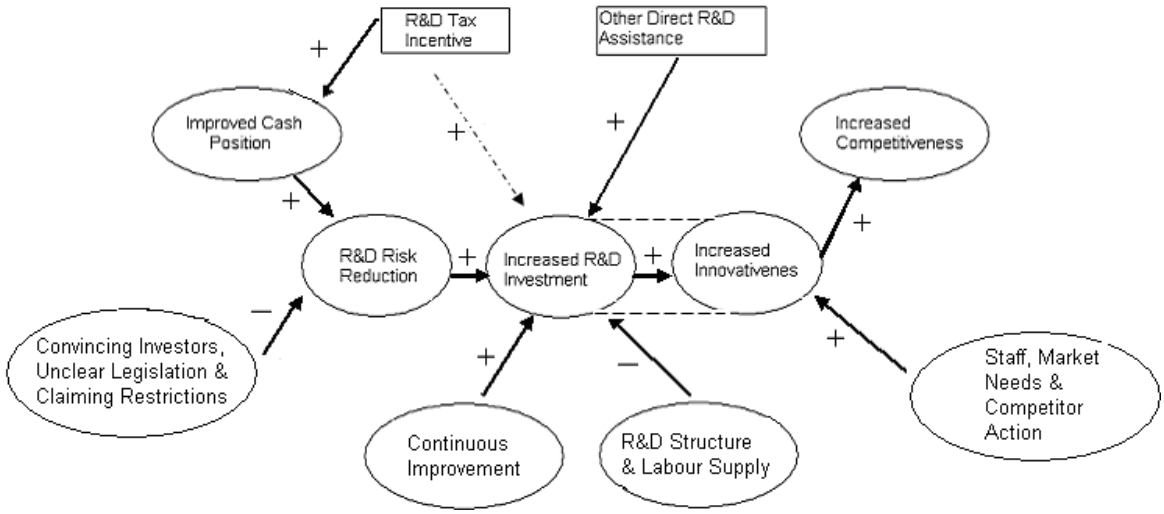

Figure 10: Overall Impact Pattern of R&D Tax Incentive in South Africa

CHAPTER 5: ANALYSIS OF RESULTS

5.1 Introduction

This chapter analyses the results presented into the last chapter in light of literature and trends in other countries. The chapter is organised along the lines of the main research questions. The results discussed here were generated through a variety of methods as stated in chapter 3.

5.2 Implications for firm level financial position and competitiveness

The findings of this study suggest that the South African R&D tax incentive programme is starting to generate impacts for the private sector. As shown in Chapter 4 in Figure 10, page 45, the overall impact pattern has the characteristics that are mentioned below.

The most significant finding was that the R&D tax incentive programme generated improved cash position across all the segments of beneficiary companies, regardless of the sectors in which they operated. These findings are reported in the previous chapter in Table 3.

Through these cash flow improvements, companies might be expected to continue to invest in R&D. The findings agree with the calculation that SA companies derive a budget saving of 14.0% from R&D tax incentive.

As one company elaborates: "*There is definitely improved cash position, otherwise the company would not survive if it would have to pay full tax*".

It is not surprising that there is a general agreement among the companies interviewed, regarding the increased cash flow as a result of R&D tax incentive. This is in line with the calculation that the after tax cost of R&D in South Africa has decreased from 63 cents (Department of Science and Technology 2002) to 58 cents for each rand spent on R&D indicating a benefit from R&D tax incentive.

The R&D tax incentive programme is therefore rebalancing risk reward relationships by offering a risk sharing between government and the private

sector. This is important especially on the multinational corporations' decision on the R&D location. As observed by KPMG (2010), countries with low total tax index such as Australia, Canada, the United Kingdom and the Netherlands tend to be the favourite R&D locations.

This observation on South Africa being positioned as the favourite R&D location opposes the findings by Lim (1983) who derived that the generosity of the incentive package in less developed countries is negatively correlated (statistically) to the foreign direct investment. This inverse relationship resulted from the fact that less developed countries are believed to overcompensate with incentives for the lack of mineral resources and the increased level of economic development. South Africa however has an abundance of mineral resources. The country is also classified as a middle- income country, with reported high levels of inequalities. Lim's findings therefore might not apply to the South African context.

The R&D cost sharing experienced by beneficiary firms synchronise well with the type of market failure noted by Bernstein and Nadiri (1988) regarding R&D having some characteristics of a public good. The state's 14% contribution to the firms' R&D costs is expected to have drastic future impact in encouraging firms to increase their R&D intensity.

One expert who participated in this study strongly believes that R&D tax incentive can give a better sector wide economic output as compared with direct R&D assistance. This is the case since the R&D decision becomes more on the R&D output demand side rather than on the R&D funding site.

In terms of the impact on competitiveness, the R&D tax incentive programme is also reportedly doing well. For the sample firms studied here, 50% of the total sample reported an increase in their local competitiveness, while 42% reported increases in their international competitiveness as a result of R&D tax incentive. The competitiveness increase included SMMEs; firms in the secondary sector and tertiary sectors; South African owned firms; and firms in the Western Cape and KwaZulu Natal. Among the companies that reported an increase in local competitiveness, 67% attributed this to reduction in factor costs, such as the

high cost of engineering skills. This is encouraging as this impact directly supports the good intentions of the South African government as noted in the 2018 Ten Year Innovation Plan.

In contrast to the above positive impacts, large companies; multinational corporations; and Gauteng-based companies although reporting improvements in competitiveness did not attribute these directly to R&D tax incentives.

The R&D tax incentive programme was reported to have a narrow focus on qualifying R&D expenditure by some of the respondents. The proponents of a narrow focus argue that this is necessary in order to avoid tax base erosion and to ensure that the R&D pattern is directed in favour of improving uniqueness and hence competitiveness of South African companies' products and services. The intention is to encourage science-based and R&D intensive innovation activities.

5.3 Change in R&D investment patterns

This section focuses on the level of change in the R&D inputs and transformation of such inputs through the R&D and innovation processes. The sources of innovation included staff, internal innovation programmes, international sources, university collaboration, market needs and competitor action.

Table 5, in the previous chapter presented data that showed that firms in the primary sector derive their innovation from internal sources including: staff; internal innovation programmes; and from their operations. These firms also reportedly derive innovation by monitoring and responding to innovative initiatives by their competitors. Company employees are also reported as the source of innovation for both secondary and tertiary sectors.

Strong collaboration is observed with the secondary sector where international and university collaborations were also reported as important innovation sources. Although both the primary and secondary sectors on the pull side of the innovation chain are driven by competitor actions, tertiary as well as

secondary sector derive their demand side innovation sources from the market needs. It is not surprising that primary sector on the demand side is driven mainly by competitors. This is the case since the market is based on commodity products in which differentiation is nearly impossible. Tertiary sector on the other end is much closer to the markets and has to respond effectively to the market needs.

The sources of innovation in Table 8, in Presentation of Results, as derived from the South African Innovation Survey (Blankey and Moses 2009) were utilized to check an external validity for the results obtained. According to the Innovation Survey, internal innovation sources account for the main production of innovation with confirmation from 56.1% of respondents in the primary sector, 54.3% in the secondary sector and 44.9% in the tertiary sector.

The innovation that results from operations overall across all the sectors is well confirmed by the combination of sources of innovation from the suppliers (24.3%) and the clients/ customers (34.5%) in the Innovation Survey. As derived from the Innovation Survey, competitors were also confirmed to be among the dominating sources of innovation (12.6%). As it is the case with the primary sector, the Innovation Survey confirmed for secondary and tertiary sectors the staff (internal source) and market needs (clients/ customers) as among the dominant sources of innovation.

Another external validation is with regard to competitors as a source of innovation for the secondary sector. University collaboration was well reflected on the Innovation Survey from just above 10% of the respondents who considered it a valuable innovation source. International innovation sources are missing from the survey although those could also be said to be captured under the suppliers' category.

Such international sources of innovation are vital in terms of technology transfer to South Africa. On the contrary, the country should balance reliance on the international innovation sources in order to be competitive in terms of value adding unique products and processes.

The thinking behind this policy framework can be illustrated by way of an example as follows; a South African pharmaceutical firm can currently go overseas to source a drug recipe that has already been discovered through the R&D process. In the short and medium term such a drug recipe can be important for the country to remain competitive internationally. Unfortunately in the long term, South Africa will not achieve its targets as set out in the Ten Year Innovation Plan to be among the top three emerging economies in the global pharmaceutical industry through the 'Farmer-to-Pharma' grand challenge, by 2018. The R&D tax incentive is intended to encourage a shift from reliance on overseas sources to internal resources.

The Presentation of Results section showed the factors that are reported to impact negatively across various segments of beneficiary companies on the R&D investment. The structure of the firm with respect to the R&D division emerged as an inhibiting factor regarding R&D investment for the large companies as well as for the primary sector while labour supply (scarce skills) is mentioned by the SMMEs, secondary sector and tertiary sector as a reason not to invest more in R&D. Secondary sector firms also mention the fear of failure as the reason not to increase R&D intensity in the sector. This represents the level of complexity of the R&D that takes place in the secondary sector.

Again, the Innovation Survey is used with regard to validation of the factors that hamper the investment in R&D which also has second order effects on innovativeness of the firms. Tertiary and secondary sectors were confirmed to have a skills shortage as one of the main factors that hamper the innovation. This is also reflected in Table 10, Presentation of Results chapter, reflecting the slow pace of growth for business R&D researchers and personnel as compared with the increase in business expenditure on research and development. The main negative factor to R&D investment not captured within this study, is the market dominance by established enterprises across all sectors.

It is interesting to note that firms in the primary sector mentioned an R&D division structure as one of the factors hampering innovation. On the Innovation Survey, firms in this sector did not mention funding and costs as being the main

cause for concern as is the case on the other two sectors, but there are emerging factors, such as ‘no need to innovate due to prior innovations’ and also as ‘there is no demand for innovation’. This well reflects the competitive strategy adopted by most primary sector companies by competing on price rather than differentiation.

The R&D Surveys’ data shows the declining expenditure by business on R&D (Department of Science and Technology 2009b, 2010). Business is increasingly dependent on increasing the proportion of government funding of its R&D, while this replaced the foreign R&D funds as opposed to complementing them. The finding that the R&D tax incentive motivates the business sector to maintain their R&D expenditures is important as the constant proportion of business R&D expenditure of around 69% started to decline to around 66% in 2007/08.

The motivation to invest in R&D due to the R&D tax incentive is in agreement to the findings by Bloom, Griffith and van Reenen (2002), that 10% fall in the cost of R&D due to R&D tax incentives stimulates just over a 1% rise in the level of R&D in the short-run, and just under a 10% rise in a long-run. The policy is therefore expected to show drastic impact in a long-term.

Nonetheless, the R&D investment motivation is sufficient, based on the principle behind indirect R&D funding by government. The R&D investment strategy is not influenced by the government but by the company that chooses its own investment strategy. This depends on other supporting and negating factors that can be addressed by direct R&D grants. One expert cautioned that both direct and indirect R&D grants are useful in their own right. It is through direct grants where the government can directly influence the choices and extent of R&D investments.

Based on the intense discussion with the government officials about Figure 5 regarding the market failure on R&D investment, there was a strong consensus that there is a general market failure in R&D investment. A point by one academic expert, that direct R&D grants are beneficial in their own right, was echoed in this discussion with the officials regarding the importance of other measures, such as the active role that needs to be played by the South African

Bureau of Standards (SABS), with regard to the provision of vital infra-technologies and programmes such as the Technology Human Resources for Industry Programme (THRIP) for science, engineering and technology-related human capital development. Human capital development is very important, especially as the skills shortage featured as one of the barriers to innovation and the employees are mentioned frequently as one of the sources of innovation.

Figure 2, in the Literature Review chapter, provides insight into a number of impacts on R&D investments by the companies following the benefit from the indirect R&D assistance by the government. These are R&D investment stimulation, crowding-out, substitution or displacement (Guellec and Van Pottelsberghe 2000: 8). Overall, the beneficiary companies had their R&D expenditures substituted as a result of policy treatment. This is not surprising, especially when taking into account the impact of recession on R&D investments. According to Irons (2009), one of the long-run impacts of the recession is on the companies (especially large ones) delaying or reducing their R&D expenditure.

Despite the impact of recession, Shah (1995) has warned that R&D expenditure relates to projects in the current year while knowledge capital is as a result of accumulated R&D expenditure over years. This again leads to discussion on factors that hamper the companies' investment in R&D which were determined to be R&D revenue structure and appropriate technical skills supply. Large companies have the disadvantage of rigid structures and systems as compared to SMMEs. It takes planning over a long time to change the financing arrangement of the R&D division for a large company, so that it can recognise tax saving from R&D tax incentive as the revenue, as opposed to tax saving being channelled to the large revenue account of the company or group.

5.4 Inhibiting factors

The majority of sample firms reported the following as significant inhibiting factors: financial resources to undertake R&D, unclear legislation and claiming

restrictions such as the R&D conducted outside South Africa. One company interviewed identified an additional challenge in terms of shortage of critical technical skills and fear of failure in undertaking R&D investment.

Of the sample, large companies, firms in the primary sector, multinational corporations and Western Cape based companies were more likely to report concerns about “unclear legislation”.

Different segments face particular challenges. SMMEs reportedly had difficulty in convincing the investors to invest more on R&D, and were not able to generate revenue to allocate towards R&D. In general, SMMEs were not able to take full advantage of R&D tax incentive’s 14.0% R&D cost savings in the short term although they would still benefit in the long- term as SARS allows for backward R&D deduction.

The first annual report to Parliament on R&D tax incentive by the Department of Science and Technology (Department of Science and Technology 2009c) shows less than 10% of BERD benefiting from the incentive as reflected by the low number of claiming forms. This confirms several challenges that inhibit the uptake on usage of R&D tax incentive in South Africa.

The definitions of qualifying R&D meant that the sectors that could benefit were not spread across the economy. Chemical Science dominated, accounting for 56.0% and Industrial Science following at 23.5%. In a far distant third, Mathematical Science, which is dominated by IT companies, accounted for only 5.1% in R&D expenditure tax benefit.

Primary sector has a low share in R&D tax incentive benefit since the Metallurgical Science is at 3.2% and Agricultural Science is at 2.0%. The small value of R&D tax incentive claim from the primary sector companies indicates the low levels of R&D intensity within this sector in South Africa. This is not surprising especially in commodity-based industries where the dominant competitive strategy is cost leadership rather than differentiation. Nonetheless, Liao and Greenfield (1997) have shown using Japanese technology based companies that both differentiation and cost leadership have considerable

impact on corporate R&D.

The Literature Review predicted challenges in terms of the accounting systems of the firms as shown by KPMG (2008) in terms of R&D expenditure documentation. This was not the case with the outcome of this study as only secondary sector firms mentioned that there are future changes pending within their accounting systems to accommodate the introduction of R&D tax incentive in South Africa. Only multinational corporations reported to have effected changes to their accounting systems.

Table 7 in the Presentation of Results chapter highlights some of the areas of improvements from the challenges experienced by the companies. Non-differentiation of R&D and innovation by SMMEs, secondary sector, tertiary sector and local companies can be among such emerging challenges.

The fact that some of the companies do not differentiate between R&D and innovation negates the linear model in Figure 7, in the Literature Review chapter, also illustrated in the fuzzy cognitive map in Figure 10, in the Presentation of Results chapter. In Figure 10, there is a form of overlap between R&D and innovation. In such instances, the company might first benefit from its innovation activities and use its resulting competitiveness to invest more on R&D at a later stage. MacDonald (1986) also opposed governments' adoption of a linear model in addressing R&D and innovation stimulation.

One of the concerns of the academic expert was on the absence of pre-registration for R&D tax incentive and too much bureaucracy that is echoed by the high level of uncertainty experienced by the companies in general. This is indicated in Table 9 in the Presentation of Results chapter. On the contrary, it was mentioned at the expert panel interview with the government role players that the pre-registration for R&D tax incentive was avoided to simplify the claiming process and hence the reduction of bureaucracy.

Both government officials and an academic expert interviewed agreed on the fact that the South African R&D tax incentive is not yet at its ideal stage but that there is room for improvement, depending on emerging industry challenges and

government priorities. Such improvement areas could be to extend the legislation to support innovation even if it does not constitute direct R&D. One company that mentioned the R&D claiming restriction cited that the R&D that is conducted abroad could not be practically conducted in South Africa. Such cases can be considered on an individual basis as long as the taxpayer can prove that it was not possible to conduct the R&D in South Africa.

SARS's opinion that communication is important between them and the taxpayers and the suggestion to use Advanced Tax Ruling, prompt the necessity for the pre-registration of R&D activities that the company is intending to base the claim at the end of financial year. The resources utilised to address the concerns and fears of the taxpayers could be channelled towards the pre-registration process which would be more upfront and provide more certainty for companies.

The general high level of uncertainty by beneficiary companies and also by non-beneficiary companies as noted from Timm (2009), Margo (2009) and Jooste (2009), is dangerous for the success of the policy, especially when one takes into account the effect of tax risk in Figure 1 (Neubig and Sangha 2004: 116). As a result, other countries that provide competitive R&D tax incentives which are on par with South Africa but with less tax risk, will attract multinationals to place their R&D centres in their countries competitively than South Africa.

5.4 Conclusion

The results confirmed the increase in cash position by beneficiary companies as a result of tax return in a form of 14.0% of operational R&D expenditure. This is in agreement with the calculation by the Department of Science and Technology (2002) that the after tax cost of R&D in South Africa has decreased from 63 cents to 58 cents for each rand spent on R&D. Improved competitiveness is reported by interviewees although there are no sufficient internal firm level indicators to link competitiveness with the benefit from R&D tax incentive.

SMMEs are better positioned in translating improved cash position into increased R&D expenditures due to less worry on their part regarding legislation

uncertainty and claiming restrictions. As opposed to large companies and multinational corporations, SMMEs also do not have structural barriers in terms of destination for R&D tax return. Nonetheless, companies who applied for R&D tax incentive in general are reporting improved motivation to invest in R&D as a result of R&D tax incentive.

Companies in the secondary sector (mainly in the chemical industry) are the main beneficiaries of South African R&D tax incentive while primary sector has a low share. The nature of primary sector as being based on commodity products imply less R&D being conducted within the sector although there is room for process R&D and innovation.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The preceding sections have laid the foundation enabling one to better describe the impact of R&D tax incentive on companies in South Africa. It is important to relate the findings back to the context of this study so that these findings can be utilised in the processes of unlocking current uncertainties regarding the impact of the programme. An application for this research is sought through a series of recommendations to both government officials and leaders of private sector companies. Complex research questions cannot be addressed through one study; hence there is a list of recommendations for future research relating to the impact of R&D tax incentives.

6.2 Implications for the study

The study has shown that the main benefit derived by companies which benefited from R&D tax incentive in South Africa is improved cash flow for the company or group. While there is no doubt about the impact on the increased cash level, this study revealed different destinations for such R&D tax return once it is received within the company, viz.: those that incorporate it back into their R&D budgets and those that don't recognise it as R&D division's income.

In general there are companies such as SMMEs that incorporate the incentive back into their R&D budgets and there will be those that draft their R&D division's budget based on the base amount of the previous year; or from zero balance without any consideration of the additional 14.0% of the previous tax year's qualifying R&D expenditure. The latter is the case especially for large companies, primary sector companies, multinational corporations and Western Cape- based companies.

Whether the increased cash flow as a result of R&D tax incentive is channelled back to the R&D division's budget or not, one can conclude that this is a

positive indicator that shows initial influence through indirect cash injection by the state to the private sector. Since the indirect R&D assistance to the private sector, such as the R&D tax incentive, is aimed to have minimal R&D decision and managerial influence on companies, it is the onus of companies to find suitable R&D investments that will bring more value added products, services and processes. The role that can be played by the state in influencing the composition and quality of R&D, is in utilizing direct grants, such as through SEDA Technology Programme, SPII, Innovation Fund, THRIP, SABS, and so on.

The inability for R&D tax incentive to stimulate a drastic increase in R&D expenditure has also been explained by negative and positive factors that affect the investment in R&D by companies. Skills shortage and misaligned R&D revenue structure were identified as dominant negative factors that affect increased R&D investment. The secondary data have market dominance by established enterprises as one negative factor. The positive factors that encourage the investment in R&D are those classified under continuous improvement such as quality and productivity. Although continuous improvement is vital on its own, this type of R&D strategy is reactive rather than proactive.

The research has also shown the significant need to address the uncertainty surrounding the qualification and allowed R&D expenditure. This is important as companies need to focus their efforts in implementing best systems to make their R&D operations more efficient and effective, rather than placing more focus on compliance and seeking consensus with the authorities on qualifying R&D activities.

The R&D definition from the Frascati manual and the innovation definition from the Oslo manual clearly show that the two are different. However the study revealed that some of the companies such as SMMEs do not have the capacity to distinguish between the two activities. As a result they could also be claiming for innovation, which is not covered under R&D tax incentive. This problem needs to be approached with caution by the authorities, bearing in mind the

goals that are being aimed at through R&D tax incentive. Increased R&D expenditure is not the ultimate goal but such R&D needs to be commercialized through innovation. Innovation in the absence of R&D can also be toxic as the value added will not be unique to the world, hence the resulting lack of global competitiveness.

On the issue of competitiveness, it was shown that there is increase on competitiveness among beneficiary companies which can be credited to R&D tax incentive (e.g SMMEs and local companies), but in some cases to the companies' own initiatives (e.g. Large companies and multinational corporations). Although there is good feedback regarding improved competitiveness, this relates more to the input site rather than the output site (competitive pricing, etc.) of the competitiveness.

One can conclude on the importance of separating the short, medium and long-term impact of the R&D tax incentive. In the short term, as shown by this research, it increases the level of cash flow within the R&D division of the company. The medium term impact is expected to be increased R&D investment, while in the long term one expects to see tangible competitiveness benefits such as increased quality employment, exports, and profitability. The reason for the government to intervene is mainly because of the declining level of R&D expenditure by the private sector while they focus on the short-term objectives. Government therefore needs to be more patient, allowing long-term research studies (such as basic research) to bring true global competitiveness for South Africa.

6.3 Recommendations

While it is encouraging to note the positive impact of R&D tax incentive on the cash flow of the beneficiary companies, there remains a challenge in terms of stimulating additional R&D expenditure above the normal budgets of companies. This is much needed for large, primary sector, and multinational corporations, in Gauteng and some Western Cape companies. That being said, from the sample demographics, it is noted that 75% of the companies

interviewed in Gauteng are large companies, while representing 50% of a primary sector and 50% of the multinational corporations. With the Gauteng sample biased more towards large companies, it is important not to make any conclusions based on the provincial data.

The solution to the lack of R&D stimulation for the above segments lies in addressing the inhibiting factors for such companies to take full advantage of R&D tax incentive and also by taking into consideration the reasons why companies do or do not implement R&D. Companies that did not increase their R&D expenditures mentioned unclear legislation and claiming restrictions as primary inhibitors for them to have full trust in R&D tax incentives.

The recommendation is to adopt the Australian model on R&D tax concession. Should this system be adopted, companies will need to fill normal R&D tax incentive forms six months after the end of their financial year and receive the claim approval from the Department of Science and Technology. The second procedure would be to indicate on the SARS income tax return the approved R&D expenditure by the Department of Science and Technology. As is the case with the Australian system, companies who wish to have their R&D activities approved in advance (e.g. for three years) need to be allowed to do so in addition to annual registration of R&D activities.

Further recommendation is to simplify the claiming process for the SMMEs who can't afford the administration burden. The form they fill in can be made lighter while their qualifying R&D expenditure approval process is made quicker without stricter approval procedures, such as waiting for the sitting of the R&D tax incentive approval committee. In the medium to long-term, a special R&D tax offset needs to be made available for these high growth technological SMMEs. This necessitates taking into consideration the fact that one of the inhibiting factors for SMMEs in utilizing effectively the R&D tax incentive is insufficient revenue.

The executives, financial managers and R&D managers from the private sector need to manage their R&D and innovation portfolios with high integration to the core strategy of the business. The main challenge, especially for large

companies, is to recognize the additional R&D revenue as a result of R&D tax incentive and to reinvest such funds in R&D without necessarily decreasing the normal R&D budget.

The motivation for conducting R&D for those companies that couldn't be stimulated to increase their R&D is through market demand, statutory compliance, continuous improvement and being technology driven. These types of R&D drivers are not strong enough because of the foundation for radical innovation which is due to their nature of being more incremental and more reactive to the external environment. Ideally, R&D should be seen as an enabler of the business strategy in such a way that it can create new markets; improve market and/ or exports share; enable product/ service diversification; improve competitiveness; among other things.

6.4 Suggestions for further research

The findings of this study are vital as a starting point in understanding the initial impact of R&D tax incentives in South Africa, which can aid better operations or future structure of the R&D tax incentive. At the same time, business leaders can recognize their role in identifying appropriate R&D investments in order to increase their R&D expenditures.

The study didn't go into detail in unpacking the nature of competitiveness derived by beneficiary companies. It would be important for future studies to categorize the nature of competitiveness, as for example in terms of revenue increase, product diversification, patents registered, publications, efficiency, market share, profitability, amount of exports, etc.

It is suggested that large-scale, long-term research be conducted covering more sample and population strata. While qualitative research is vital on new topics such as R&D tax incentive, quantitative econometric methodology can be useful in addressing key issues surrounding reliability and validity in order to make the best informed decisions surrounding policy direction and implementation.

A more complex but very necessary study is one that looks into various

research and development, and innovation assistance (direct and indirect) by government to the private sector to investigate their combined impact on research, innovation and competitiveness. This is prompted by the fact that investment decisions at firm level are based on integrated planning, which takes into account numerous internal and external factors holistically.

6.5 Conclusion

The South African R&D tax incentive has shown promising signs of impact, especially with regard to the cash position of the companies. The main beneficiaries are the chemicals industry companies in the secondary sector while primary sectors benefit only about 5% of the R&D tax incentive.

The challenge with regard to segments such as the large companies is to ensure that the additional cash saving due to R&D tax incentive is channelled back into the R&D budget. Unfortunately the government can only control significant incremental increase of R&D expenditure by providing enhanced R&D tax incentives, as R&D intensity is shown to correlate positively with more internal management control rather than external control.

The policy should be expected to produce significant impact in the long-term as it is intended to remove short-term focus within the companies. But, more caution needs to be taken to ensure clear interpretation and effective implementation of Section 11D to remove any legislation uncertainty that might affect the intended policy outcome negatively. Pre-approval of applications before R&D expenditure is committed will be among such measures to improve the administration of this policy.

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APPENDIX A

Letter to Respondents

Dear Respondent

I am completing an MBA at the University of Witwatersrand, Johannesburg (Wits) and employed by the Department of Science and Technology. My thesis is on the evaluation of the impact of the recently introduced R&D tax incentive on firms in South Africa. I would be grateful if I could arrange a one-hour interview with you to understand how this policy instrument has impacted your company. I understand you are extremely busy and your agreement to contribute to my research is greatly appreciated.

Your responses will be treated with anonymity, and you will be able to see the copy of questions before the interview to enable you to gather appropriate information. Confidentiality will be observed throughout the thesis process and the final report will be for academic purposes only.

I am available to meet you at your location and time of your convenience.

Thank you for your kind assistance.

Yours sincerely,

Petrus Letaba

Actual Research Instrument

Interview Questions

- How does R&D tax incentive improve the cash position of your company?
- Is there any significant increase in R&D expenditure due to R&D tax incentive?
- Is there any other factors rather than R&D tax incentive that stimulate R&D investment in the firm?
- How are the costs of R&D since the introduction of R&D tax incentive?
- To what extent your company distinguish between R&D and innovation?
- What are the sources of innovation within the company?
- Can you describe type of change in local competitiveness of a company since its benefit from R&D tax incentive?
- Can you describe type of change in international competitiveness of a company since its benefit from R&D tax incentive?
- In addition to below known factors that affect the claim on R&D tax incentive:
  - R&D definition within your company versus that of SARS/ DST,
  - Company documentation of R&D activities,
  What are other factors affecting the use of R&D tax incentives?
- What can you say about the risks on claiming for R&D tax incentive?

Expert Interview Questions

- Indirect or direct assistance can be provided in incentivizing companies to conduct R&D, what are the reasons to choose R&D tax incentive?
- Having different options with R&D tax incentive (pre-registration, incremental expenditure incentive, foreign investment incentive, etc.), why was it specifically structured in its form?
- What are the policy objectives of South African R&D tax incentive?
- How is the policy performing and its outcomes up to date?
- Are there any policy problems being experienced?

APPENDIX B

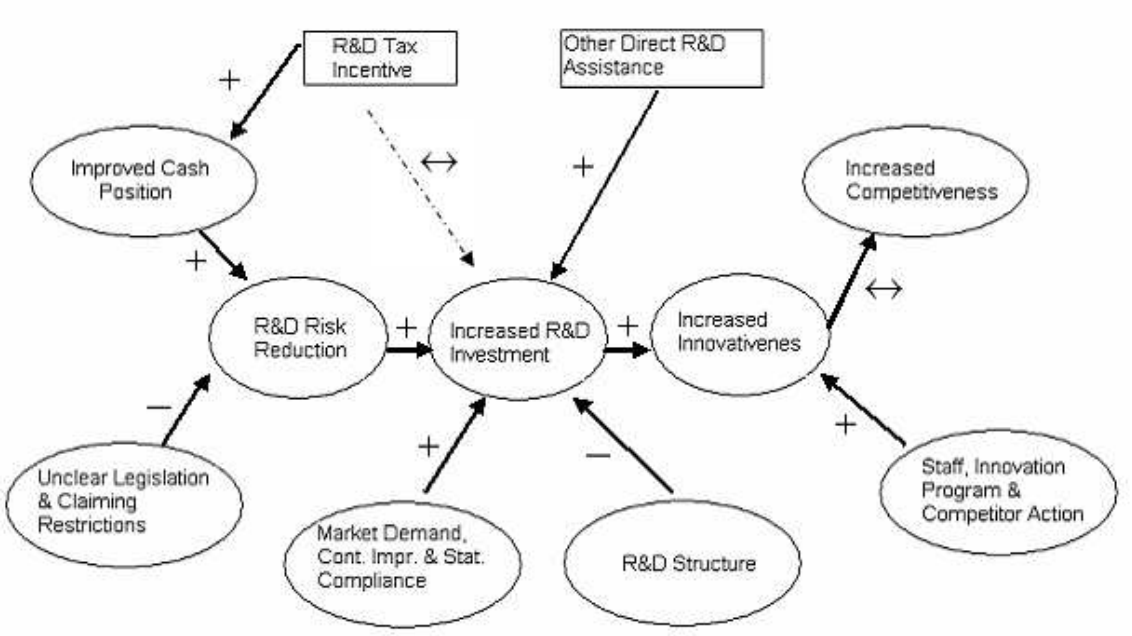

Figure 11: Fuzzy Cognitive Map for Large Companies

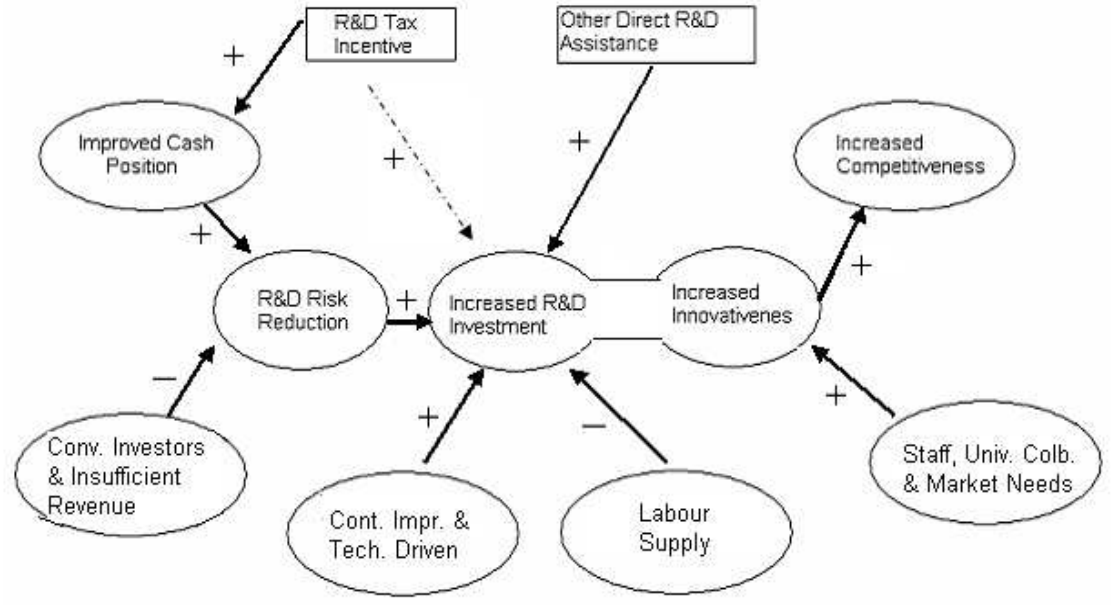

Figure 12: Fuzzy Cognitive Map for SMMEs

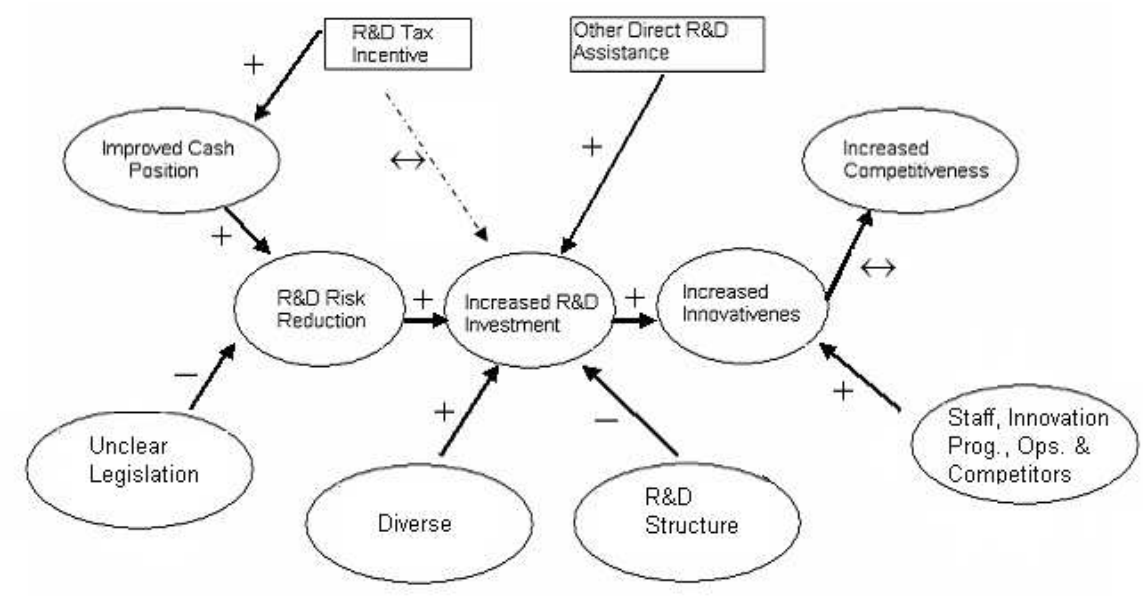

Figure 13: Fuzzy Cognitive Map for Primary Sector

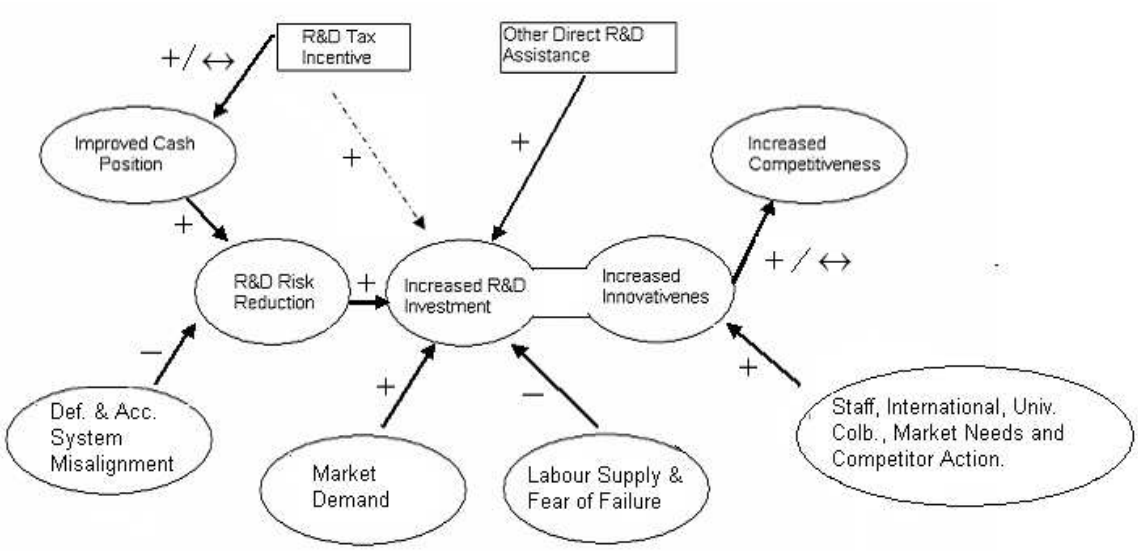

Figure 14: Fuzzy Cognitive Map for Secondary Sector

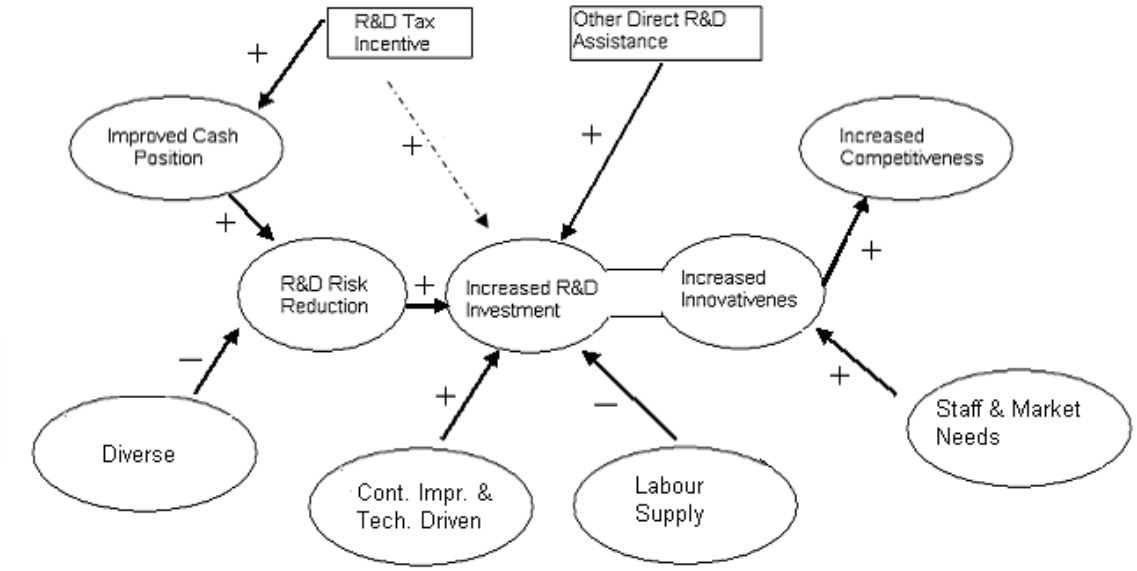

Figure 15: Fuzzy Cognitive Map for Tertiary Sector

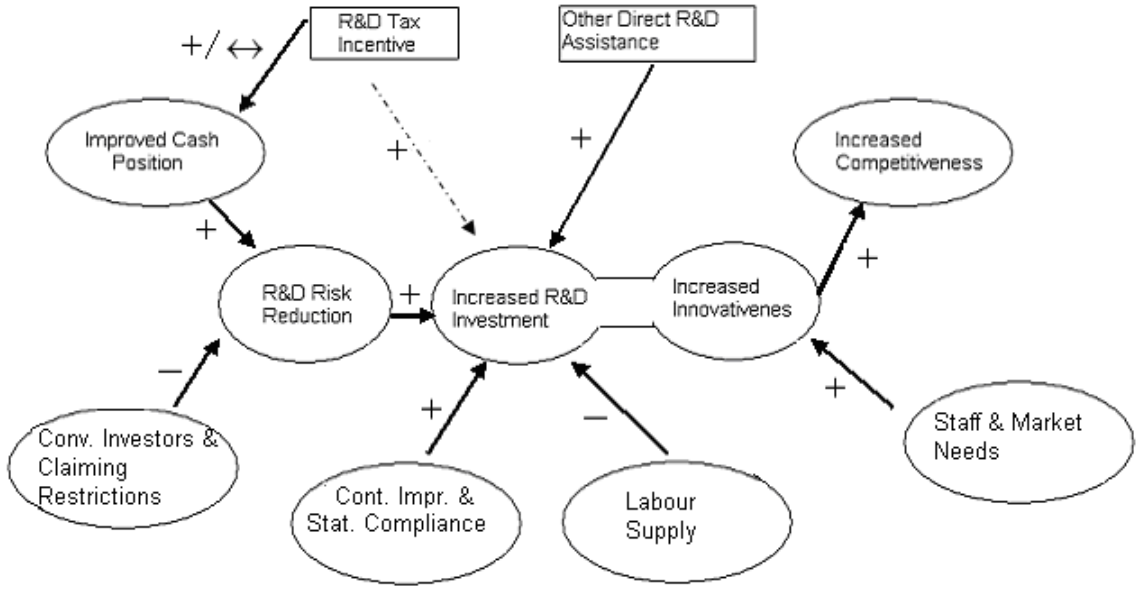

Figure 16: Fuzzy Cognitive Map for Local Companies

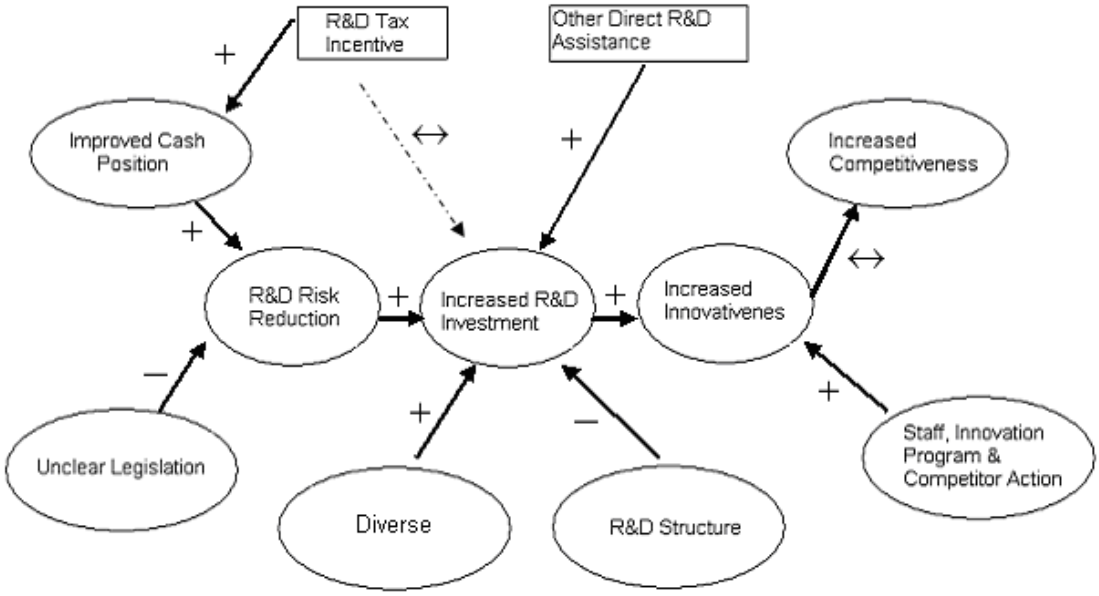

Figure 17: Fuzzy Cognitive Map for Multinational Corporations

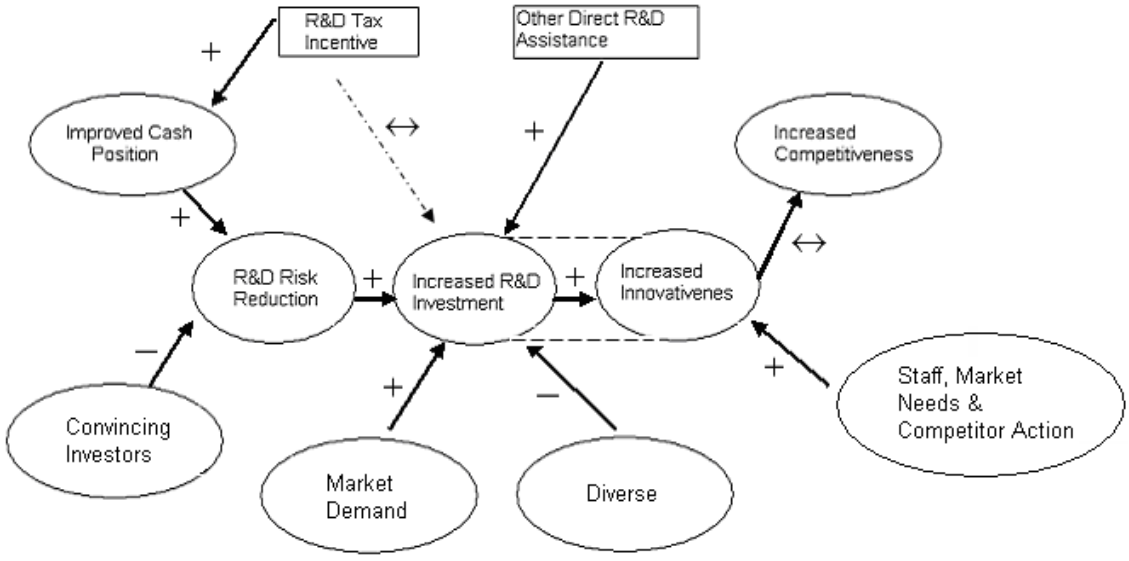

Figure 18: Fuzzy Cognitive Map for Gauteng Companies

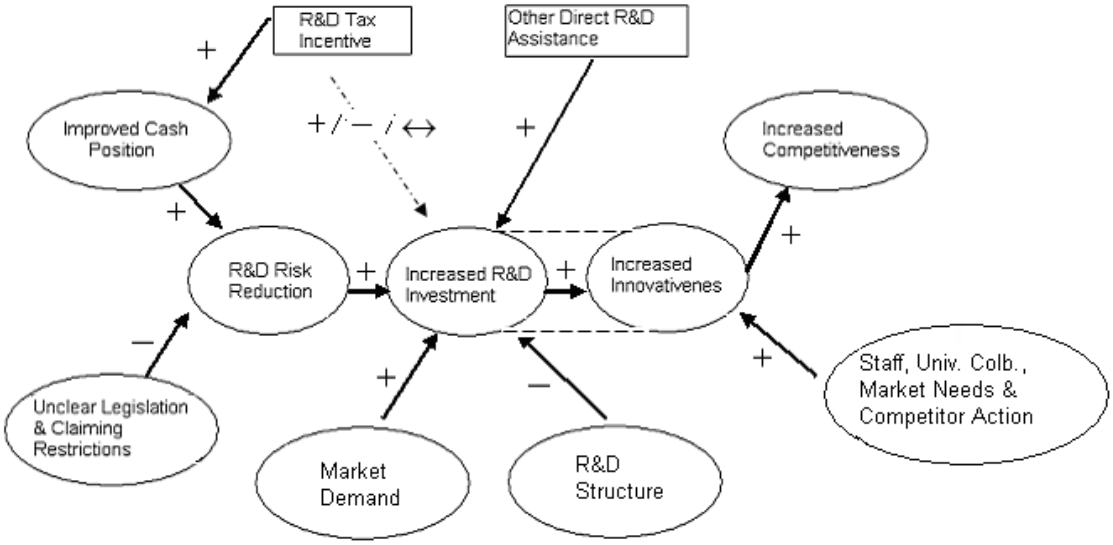

Figure 19: Fuzzy Cognitive Map for Western Cape Companies

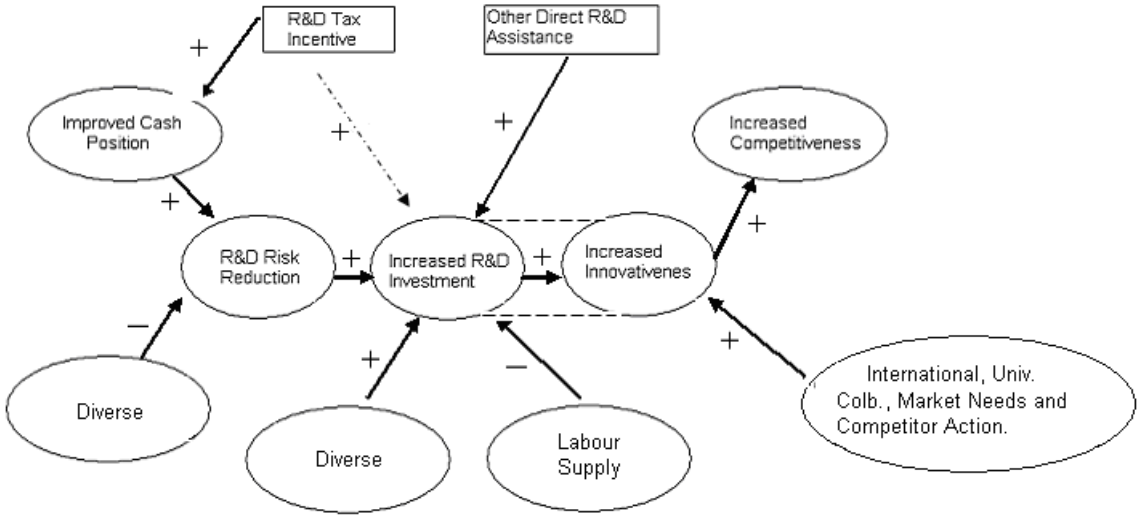

Figure 20: Fuzzy Cognitive Map for KwaZulu Natal Companies