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Investigating the drivers of growth in an automotive components industry – Explaining the high growth of the South African catalytic converter industry.

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria, in partial fulfilment of the requirements for the degree of Master of Business Administration.

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Abstract

This research addresses the drivers of growth in an automotive components industry. This research looks at a sub-sector within the South African components industry namely the catalytic converter industry. This research investigates foreign ownership, innovation activities and levels of education as possible drivers of growth in the catalytic converter industry. This research compares the results of the analysis on foreign ownership, innovation activities and levels of education of the catalytic converter industry against the results of the components industry. The reason for doing that is to see if there are significant differences between the two industries. This research made use of data collected as part of a collaborative study that was conducted in the total South African components industry. In 2007 the catalytic converter industry was responsible for 55 percent of the R39 Billion worth of the total components that was exported. The purpose of this research is to understand what drives growth in the catalytic converter industry. The findings of this research do not provide enough proof to exactly identify why the catalytic converter industry is so successful if compared against the components industry. No significant difference was detected when the results of the catalytic converter industry is compared against the results of the components industry in terms of innovation, levels of education and levels of foreign ownership. The only slight difference that was measured was that the probability of some product and process innovation taking place in the catalytic converter industry is higher than the probability that some product and process innovation taking place in the components industry. This is not enough proof to differentiate the two industries completely from each other. Many questions remain unanswered on what exactly drives the success of the catalytic converter industry. Further in-depth qualitative as well as quantitative studies must be conducted to understand the South African catalytic converter industry in full.

Declaration

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

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Kobus de Klerk

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Chapter 1

Introduction to the research problem and purpose.

1.1 Introduction

The aim of any business is to make money. A business is always looking for more and better opportunities. The aim of any business is to create wealth for its shareholders. A business uses its investments to generate a positive ROI (Return on Investment), which must be higher, due to risks associate with a business, than the return on low risk investments such as putting the money in the bank. If this is not the case a business will not exist nor grow. According to Kaggwa, Pouris and Steyn (2007) in the long run it is the investments in R&D and the subsequent potential to innovate that is likely to determine industry competitiveness. The nature of investment undertaken in any industry has a bearing on the process towards achieving competitiveness in the industry.

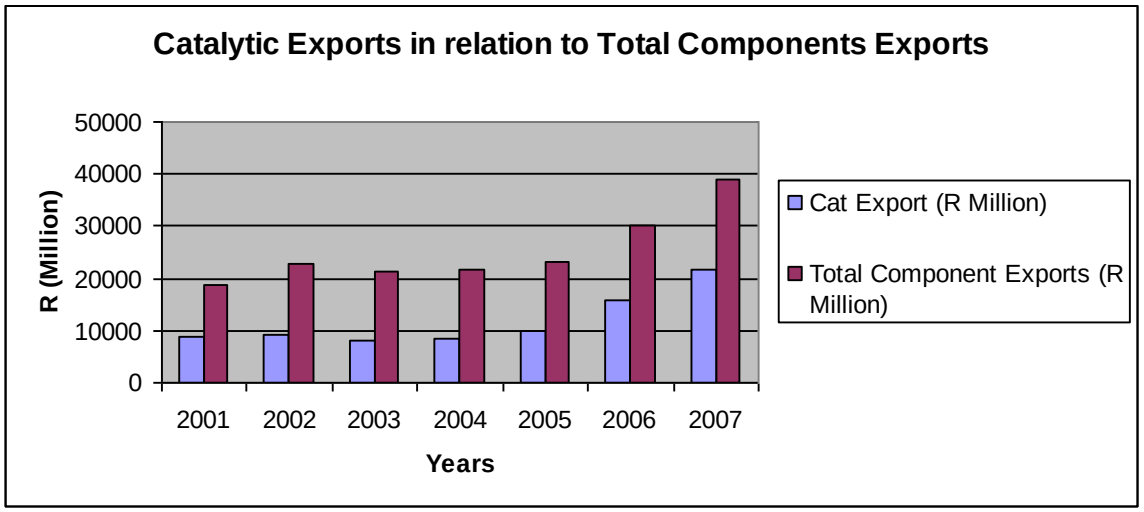
According to Flatters (2005) FDI (Foreign Direct Investment) has increased sharply since 1995 in the South African automotive industry. Competing in the world automotive supply chain is very competitive. It requires high investment, it requires highly skilled and educated labour in terms of manufacturing and development and it requires advanced technology. According to Zhu, Xu and Lundin (2006) sustainable industry competitiveness is only achieved by advanced technology, and developing such technology is costly in terms of time and financial resources. According to Flatters (2005) the high level of FDI seen in the South African automotive industry is as a result of the MIDP (Motor Industry Development Plan) and subsequent PAA (Productive Asset Allowance) incentive. Since 1995 the South African automotive industry is doing very well. Investment in the industry is high and exports have grown. Did the investments in the automotive industry include investments in R&D? Is this a sign that the industry has achieved advanced technology through R&D and therefore obtain

industry competitiveness? The objective is to determine if this is the case, and therefore explain the growth the automotive industry has seen since 1995.

1.2 The purpose of this research.

The purpose of this research is to take a look at why the automotive industry is growing, with particular interest to the catalytic converter industry a sub-group within the components industry. One would ask why is research of the catalytic converter industry as a sub-group of any importance. Why could results of the total components industry not reflect on the catalytic converter industry as well? Since 2004 the catalytic converter industry has seen phenomenal growth in export value. The exports of catalytic converters has grown from 38 percent of the total component export value in 2004 to 55 percent of the total export value in 2007, as illustrated in the graph.

Graph 1: Catalytic Converter Export History Summary



Source: Compiled from NAACAM data (2009.09.16)

It is argued that FDI is the carrier of advanced technology to developing markets. (Sadoi (2008); Doctor (2007); Busser (2008), Lorentzen and Barnes (2004)) Zhu, Xu and Lundin (2006) state that sustainable industry competitiveness is only achieved by advanced technology. This research will investigate the levels of FDI in the catalytic converter industry. Higher levels in the catalytic converter

industry may indicate the presence of advanced technology and explain why the industry has seen such phenomenal growth. This research will investigate the innovation activities of the catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training. A positive results of the investigation may indicate why the industry is growing and confirm the statement of Zhu, Xu and Lundin (2006). This research will also look at the employees in the catalytic converter industry, in terms of technical skills, university qualifications and post-graduate qualifications. Bakker, Oerlemans and Pretorius (2008) state that in comparison to several European countries where R&D efforts are highly important to innovation outcomes, South African firms generally tend to profit far more from their higher educated employees. A positive result of the investigation may indicate why the industry is growing and confirm the statement of Bakker, Oerlemans and Pretorius (2008). This research will benchmark the catalytic converter industry against the components industry in order to interpret results and explain findings.

The researcher is of the opinion that an effort must be made to understand the catalytic converter industry better and to treat it as an individual sub-group within the total South African automotive industry. No evidence of any other study (as far as the opinion of the researcher) is available on the catalytic converter industry. The research of Lorentzen and Barnes (2004) on learning, upgrading and innovation in the South African components industry included only one catalytic converter manufacturer. This indicates that the catalytic converter industry is classed under the components industry. The authors conclude that local innovation is only possible under certain conditions. The authors state that for technological upgrading to take place in developing countries such as South Africa, what matters is:

(i) the availability of foreign capital,

(ii) the presence of local capabilities,

(iii) the industry must be located in a core group of technology-leading countries, and

(iv) Company involvement and association with high technology clusters.

For the purpose of this research, attention will be given to the first two conditions, and the impact of those to innovation activities within the catalytic converter industry. Depending on the findings of this research it might contribute to policies that will benefit other South African industries, as well as ensuring the sustainability of the catalytic converter industry in South Africa.

1.3 The scope of the research

In collaboration with the University of Pretoria and NAACAM (National Association of Automotive Component and Allied Manufacturers) research is conducted on innovation activities in the South African components industry. This research benefits from the larger collaborative research that is conducted. This research is aimed at a sub-group in the components industry namely the catalytic converter industry. The aim is to collect data from all catalytic converter canners, by using the exact same questionnaire submitted to all other component manufacturers. The data for the catalytic converter industry will then be analyzed and compared to the data of the other component manufacturers and reported.

Chapter 2

Literature Review

2.1 Introduction.

Karl. R Popper explains theory as nets cast to catch what we call the world, to rationalize, to explain, and to master it. We endeavor to make the mesh ever finer and finer. According to Zikmund (2003), theory is a set of general propositions used to explain the apparent relationship among certain observed phenomena. Theories allow generalizations beyond individual facts or situations. The purpose of this academic literature review is to investigate and understand what current literature says about FDI and innovation. Specific focus is given to the sub-sector within the South African automotive component manufacturing industry namely the South African catalytic converter industry.

The first section focuses on foreign ownership. Foreign ownership is discussed on the generic, country, industry and industry sub-sector level. The second section focuses on innovation. Innovation is discussed on the generic, country, industry and industry-sub sector level. This literature review then discusses the relationship between FDI and innovation. Because this research is aimed at the catalytic converter industry of South Africa it is necessary to find evidence relating specifically to this industry. The literature review then concludes.

2.2 Foreign Ownership

The oxford dictionary explain the word “foreign” as something related to other countries, and the word “ownership” a derivative from the word “owner”, as a person or entity who owns something. For the purpose of this research “foreign ownership” refers to the complete or majority ownership or control of a business in a country by companies whose headquarters are not in that country. The starting point for explaining foreign ownership is to analyze FDI.

The research of Oxelheim et al (2001) introduces the concept of the OLI (Ownership, Location & Internalization) paradigm for understanding FDI. The OLI paradigm attempts to answer three questions about FDI. The first is based on present and potential ownership advantages, should a particular firm be involved in foreign markets? The second based on location advantages, where should the firm invest abroad? The third, how should the firm serve foreign markets, should it be through internalization or through arms-length arrangements such as licensing or export through intermediates?

The “O” in the OLI paradigm refers to the ownership specific advantages of the firm. Oxelheim et al (2001) state that over the years the firm developed specific characteristics to be in a competitive situation in their home economy. These characteristics must then be transferable abroad and be strong enough to compensate for the extra costs associated with doing business abroad. The characteristics referred to be the proprietary knowledge incorporated in economies of scale and scope, managerial and marketing expertise; advanced technology obtained from R&D and differentiated products.

The “L” in the OLI paradigm refers to location specific advantages that attract FDI to a specific market. Aliber (1970) suggests that some FDI is motivated by imperfections in the foreign exchange markets. Dunning (1993) states that the propensity of firms to own foreign income generating assets may be influenced by financial and exchange rate variables. Oxelheim et al (2001) state that the influence of foreign exchange imperfections are a reactive strategy aimed at benefitting from market imperfections. Saggi (2002) shows that trade cost saving is a rationale for many companies in doing FDI in specifically developing nations. Bagwell and Staiger (2003) show that if a foreign firm has information about its marginal cost of production and competes with domestic firms, the foreign firm can do FDI even if FDI does not reduces its cost of production but helps to convey its true cost of production to the domestic firms. Thus it shows that signalling true cost of the foreign firm can be a motive for FDI. Barba, Naretti

and Venables (2004) find that a lack of human resource inadequacy in some developing countries deters FDI from happening. This suggests that a workforce with skills and capabilities are important for attracting FDI. Cheap labour is not the most important factor nor sufficient in attracting FDI. Dunning (1988), Lucas (1990) and Zhang & Markusen (1999) confirm this statement. The quality of the labour force plays a crucial role. Noorbakhsh et al. (2001) find that human capital is one of the most important determinants of FDI flows to specifically developing countries and that this importance has increased over time. Agosin and Machado (2007) conclude that the size of domestic markets matters the most to foreign investors.

The “I” in the OLI paradigm refers to internalization factors in the OLI paradigm. Oxelheim et al (2001) state that current theory on “internalization” suggests that it is critical for a firm to constantly upgrade their proprietary information, and to control the human capital that discovers it. This is achieved through extensive research to develop expertise in technology, management and marketing. It therefore suggests that a firm would choose to serve a foreign market through FDI rather than to pursue alternative options without ownership control of the foreign entity. This would be the best tactic to protect proprietary information and draw the full benefits from the new market. Without total ownership MNE’s would face high monitoring costs of its relationships with the subsidiaries. Ownership control through FDI is thus a response to market imperfections in the market for intermediates, such as knowledge, management, and corporate control.

Oxelheim et al (2001) suggest that a fourth pillar be added to the traditional OLI paradigm. This fourth pillar is finance specific factors. The authors suggest that proactive financial strategies associated with FDI result in financial gains for the company. The proactive financial strategies suggested include the competitive sourcing of capital globally, cross listing on foreign exchanges, providing accounting and disclosure transparency, maintaining strong commercial and investment banking relationships, maintaining a strong credit rating, negotiating

financial subsidies and reduced taxation, reducing financial agency costs through FDI and reducing operating and transaction exposure.

2.2.1 Foreign Ownership in South Africa

South Africa did attract some substantial foreign investments over the past few years as suggested by Flatters (2005), but in comparison to other developing nations relatively very little. MNE's look at South Africa in terms of the size and the future growth potential of its domestic market, the potential benefits from imperfections in the exchange rate, the quality and capability of the South African workforce as well as finance specific factors from which they can benefit.

South Africa does present a lucrative and growing new market for MNE's. Rivero, du Toit, and Kotze (2003) conclude that the South African middle class provide such an opportunity. The middle class in South Africa as a whole increased considerably in size, from 8.8 percent of the population (around 3 571 350) in 1994 to 11.9 percent (around 5 333 550) in 2000, and is still growing. Benefiting from imperfections in the exchange rate the research of Wessels (2004) explains that since the demise of the Bretton Woods system countries has a wide choice of exchange rate regimes. These include fixed versus floating regimes as well as pegs (soft and strong) and intermediate exchange rate regimes. It is usually the emerging countries that are on the receiving end of currency imperfections. This is evident from the currency crises in Mexico, East Asia, Brazil, Argentina and Russia. Emerging countries also suffer the most as a result of the crises stemming from the maintenance of pegged exchange rate regimes. South Africa is an emerging economy with a volatile currency. MNE's can benefit from potential imperfections in the exchange rate and the volatility of the Rand. The availability, capability and quality of the South African workforce are not good at all. Wocke and Klein (2002) state that South Africa suffers from a shortage of skills, while at the same time having an excess of unskilled labour. The brain drain and the impact of HIV/Aids are threats to the current skills level in the South African labour force. Skilled workers generally create jobs for unskilled

workers, and the level of skills in the labour force is an attraction for foreign investment.

The South African government is also playing an important role to improve conditions for FDI. In an overview of South Africa's country condition and climate for investment and trade, done by the Political Risks Services (PRS) group, dated 1 September 2008, the following positive and negative aspects about investing in South Africa were stated. On the positive side, the government of South Africa is open to foreign investment, which it views as a means to drive growth, improve international competitiveness, and obtain access to foreign markets. Virtually all business sectors are open to foreign investors. Since 1994, the government has sought to liberalize trade and enhance international competitiveness by lowering tariffs, abolishing most import controls, undertaking some privatization, and reforming the regulatory environment. In January 2005, Moody's assigned South Africa a sovereign debt rating of "Baa1", three steps into investment grade. Standard and Poor's and Fitch also rank South Africa at investment grade. The DTI offers six investment incentives for manufacturing in South Africa. These are:

(i) Foreign Investment Grants,
(ii) Industrial Development Zones,
(iii) The Skills Support Program,
(iv) The Strategic Investment Project,
(v) The Critical Infrastructure Facility, and
(vi) The Small and Medium Enterprise Development Program.

All incentives are aimed at attracting foreign and local investment. These investment incentives are all finance specific factors from which MNE's can benefit. On the negative side, a 2005 survey of South African businesses indicate that the lack of skilled labour, the strong rand limiting exports, labour relation problems, and crime influence investment opportunities negatively. A 2005 survey conducted by the American Chamber of Commerce in South Africa reinforced these views. Black Economic Empowerment (BEE) has been at the

centre of business-government relations for the past several years. While supporting the need for affirmative action, many foreign investors have commented that there was a lack of clarity surrounding the application of Black Economic Empowerment. This resulted in a dampening effect on their plans to further invest in South Africa. Poor or unclear regulations in key sectors, such as telecommunications, have sometimes acted as a disincentive to investment. In instances where the regulator is weak and unable to enforce its own regulations, foreign firms may find themselves at a disadvantage to domestic companies.

The expected levels of FDI hoped for by government since liberation in 1994 did not materialize. All incentives introduced by government thus far also did not result in attracting the desired levels of FDI. Flatters (2005) states, some South African industries have seen higher levels of FDI than others. Due to the lack of expected FDI in most South African industry sectors and to alleviate high unemployment, the government has focused on quickening the pace of economic growth and job creation. Given steady domestic investment the government is convinced that the public sector must take the lead by investing in the nation's inadequate infrastructure. Under the governments new Accelerated and Shared Growth Initiative of South Africa (ASGISA), unveiled in 2006, state-owned enterprises plan to invest more than $25 billion over the next four years, mainly on transportation infrastructure, telecommunication networks, and energy. Other key elements of ASGISA include labour market reform, improved delivery of public services, skills development, a revamped industrial policy, and support to small business. It is believed that this will act as incentives for future FDI in South Africa.

2.2.2 Foreign Ownership in the SA Automotive Industry.

The South African automotive industry can be classed as an industry that did receive substantial FDI since 1995. According to Barnes (2000) the South African automotive industry is controlled by the OEM's (Original Equipment Manufacturers). The automotive component firms are reliant on the OEM's for their economic well-being. In the era prior to 1995, because of various policy

mechanisms, OEM's were forced to purchase from domestic component firms giving the component firms a level of economic leverage. In 1995 the South African automotive industry was liberated. This resulted in major transformation in the components industry. This transformation was being strongly led by changes at the OEM level. The fundamental difference is the outward orientation of the industry as brought about by the launch of the MIDP in September 1995. This outward orientation has been enforced through a number of policy mechanisms that have drawn the industry into a global operating environment. These changes have removed all protection from the automotive components industry and through the removal of local content requirements ensured its dominance by the OEMs.

Since 1995 all OEM's with the exception of Toyota changed back to a majority foreign ownership. BMW and Mercedes always stayed 100 percent foreign, even through the apartheid years. Barnes (2000) states that these ownership changes on the side of the OEM's meant that the OEM's needed to fall in-line with their parent company operations, resulting in the rapid reorientation of their presence in the global industry and by implication their own position within the global value chain. This change had enormous implications for the domestic automotive component firms feeding into the OEM's.

Barnes (2000) states that due to their past inefficiencies component manufacturers were not internationally competitive. Their inefficiencies were protected by the government, resulting in them becoming uncompetitive. As a result many were not considered for on-going business opportunities with OEM's. OEM's demanded different equity relations between their domestic component suppliers and their parent company's component suppliers. In the past many component manufacturers operated through a licensing agreement and the domestic entity would pay royalties. Now OEM's demands that domestic suppliers have an equity relationship with the owners of their designs.

These changes forced many traditional South African component manufacturers to change their business completely or sell their majority equity to international firms. Barnes and Kaplinsky (2000) explain this as – "where local production of components is involved, there is decreasing space for locally-owned component suppliers and almost no space for component suppliers using local technology. South African component suppliers are thus increasingly being relegated to highly competitive niches in mature technologies in external after-markets, making them vulnerable to exchange rates". The South African components industry faces challenges on two fronts. The first is that they need to constantly improve their competitiveness to keep foreign imports out of South Africa, and secondly their repositioning in the new value chain in order to consolidate relationships with OEM's and therefore facilitates exports.

According to Barnes (2000), for domestically owned component manufacturers to export they must use domestic OEM's as conduit for exporting or generate a close relationship with first tier MNE's component suppliers. All findings points to the fact that domestically owned manufacturers will have an extremely hard time to stay within the global automotive supply chain. It is most likely that domestically owned component manufactures be bought over by foreign entities if not already owned by foreigners.

For the South African catalytic converter industry virtually no theory could be detected on ownership. The CCIG (Catalytic Converter Interest Group) also does not provide any insight in this regard. The catalytic converter industry can be regarded as a sub-sector within the components industry, thus in all likelihood it should have exactly the same characteristics as the components industry in general.

2.3 Innovation

The Oxford dictionary explains the word "innovation" as something completely new. Innovation may refer to incremental, radical, and revolutionary changes in thinking, products, processes, or organizations. A distinction is typically made

between invention, an idea made manifest, and innovation, ideas applied successfully. According to Mckeown (2008) inventions are usually a result of R&D activity and forms part of the innovation process.

Most of the widely used definitions of innovation focus on novelty and newness. Schumpter (1934) defines five types of innovation. These are:

(i) introduction of a new product or a qualitative change in an existing product,
(ii) process innovation new to an industry,
(iii) opening of a new market,
(iv) the development of new sources of supply for raw material and
(v) other inputs and changes in the industrial organisation.

Davilla et al (2007) describe product innovation as the introduction of a good or service that is new or substantially improved. This includes, but is not limited to, improvements in functional characteristics, technical abilities, or ease of use. Process innovation is about changes in the technologies that are integral part of product manufacturing and service delivery which can result into better, faster, and less expensive products and services. New markets and new sources of supply for raw material are self explanatory. Other inputs and changes in the industrial organization refers to the adoption of changed management processes such as 6 Sigma, TQM or the adoption of some sort of quality system to improve the overall performance of the organization.

It is evident that many forms of innovation exist. Theory does confirm that not all innovation activities are reliant on R&D activities. These innovation activities may however not result in advanced technology. Innovation activities of countries, industries and organizations vary. It varies from very active to none at all. Several reasons might contribute to the level of innovation. According to Amabile et al (1996) innovation begins with creative ideas. Creativity by individuals and teams is a starting point for innovation; the first is a necessary but not sufficient condition for the second. In order to be innovative, employees have to be

creative. Creativity is a result of the environment created by companies and government.

According to Balzat and Hanusch (2004) levels of innovation are shaped by the NIS (National Innovation System) of a country. A national innovation system is a historically grown subsystem of the national economy in which various organizations and institutions interact with and influence one another in the carrying out of an innovative activity. It is about a systemic approach to innovation in which the interaction between technology, institutions, and organizations is central. Innovation leads to economic gains. It is important that a country develop a national innovation system. It is the responsibility of government to establish such a system. It is then important that government support such a system through setting policy that enables innovation activities in business. It is the fruits of a working NIS that attracts FDI and advanced technology. .

2.3.1 Innovation in South Africa

According to Pavcnik (2003) globalization provides competitive pressures necessary for local firms to undertake technological upgrading. According to Oerlemans, Pretorius, Buys and Rooks (2003) innovation is one of the driving forces behind a nation's economic development and the competitive advantage of its firms. Mainga, Hirschsohn and Shakantu (2009) state that for a developing country such as South Africa, successful integration into the global economy requires that local manufacturing firms are able to competitively restructure, as a precondition for survival and long-term growth. Consequently, skills and technological upgrading are crucial in raising the international competitive advantage of local firms.

Zhao, Anand and Mitchell (2005) state that organisations in emerging economies generally attempt to gain access to the technological resources of firms in developed countries as a means to becoming more innovative and ultimately

more profitable. Maher and Christiansen (2001) state that the three basic ways for countries to acquire technology are: export, licence, and FDI. FDI is one of the means available for a firm to transfer technology outside its home country, or that a host country can use to acquire technology. A firm may export products that embody the technology, a firm may license its technology to an agent abroad who then uses the technology to upgrade its own production, or a firm can set up a foreign establishment using FDI to exploit the technology itself.

Bakker, Oerlemans and Pretorius (2008) state that in order for the successful transfer of technology to occur the sender firm needs to be infectious and the receiver firm must be susceptive. The greater the levels of infectiousness from the host firm and susceptibility of the receiving firm the greater the chance of success for innovation to take place. Another important factor is the absorptive capacity of the receiving firm. Samaddar and Kadiyala (2006) state that "absorptive capacity" refers to the organizations ability to recognize the value of new, external information, assimilate it, and apply it for competitive advantage.

The research of Bakker, Oerlemans and Pretorius (2008), show that having an innovation partnership, particularly an international partnership, is beneficial to innovation outcomes in South Africa. It also emerges that too diverse a set of international partnerships is detrimental to innovation outcomes. The research investigated the impact of domestic and international innovation partnerships on the innovation outcomes of SA firms. The results, that emerges from this research points to important factors on South African firms for innovation. First the strength of the internal knowledge base does indeed matter for innovation outcomes of SA firms. In comparison to several European countries where R&D efforts are highly important to innovation outcomes, SA firms generally tend to profit far more from their higher educated employees. It points to the importance of embodied knowledge for innovation in SA. Innovation is truly a human matter that seems less dependent on formalised R&D activities in SA firms. Low R&D investments by SA firms, as well as the impact of the "brain drain" can be

considered a substantial loss for the national knowledge resource base. Utilising external knowledge resources, that is, inter-organisational networking, is conducive to innovation outcomes. Having international partnerships has a stronger impact on SA firms' innovation outcomes than having domestic ones. South African firms have demonstrated the ability to tap into international knowledge flows and to adapt "foreign" knowledge to local conditions ("absorptive capacity"). This compensates for an internal lack of technological capabilities because of low R&D investments.

2.3.2 Innovation in the SA Automotive industry.

The South African automotive industry is now fully part of the global automotive supply chain. This is because of the MIDP that was introduced by government in 1995. The changes brought by the MIDP have removed all protection from the automotive components industry. Domestic component manufacturers are now forced to upgrade in order to become competitive. Since 1995 OEM's as well as component manufactures became more foreign owned. OEM's demanded that domestic companies have an equity relationship with the owners of the designs they manufacture. At first glance it seems that the change to foreign ownership in the automotive industry would negatively affect the South African automotive industry. Maybe this was exactly what the South African automotive industry required. According to Lorentzen and Barnes (2004) what matters for technological upgrading to take place are the availability of foreign capital and the presence of local capabilities to make good use of it. When foreign and local inputs match well, technological transfer and diffusion may take place and move the developing country forward. Several other authors confirm that FDI carries advanced technology and that once a country houses these technologies, that country will have a relative strong point of departure for developing its industrial base further. (Sadoi (2008); Doctor (2007); Busser (2008), Lorentzen and Barnes (2004))

Lorentzen and Barnes (2004) state that inflows of superior foreign technology may enhance incentives for innovation because of the competitive climate they create or alternatively they may obviate the need for indigenous generation of technology through the creation of no-need-to-reinvent-the-wheel type situations. What seems to be the case for the South African automotive industry? According to Flatters (2005) FDI has increased sharply since 1995 in the South African automotive industry. This should indicate that innovation is thriving inside the South African automotive industry. The fact that FDI occurs in an industry does not mean it automatically translate into advanced technologies. Lorentzen and Barnes (2004) state that technology transfer and diffusion are empirically hard to operationalize. In studies of firms that overcome problems of intractability it is often concluded that multinational investments do not necessarily lead to spill-overs in the host economies.

First prize for a developing economy and its automotive industry would be to get involve in R&D activities to develop advanced technology. Lorentzen and Barnes (2004) state that a number of observers concluded that developing country firms are likely to lose design and engineering capabilities, and that the auto industry will contribute little to the hoped for technological capability. For the South African automotive components industry, Lorentzen and Barnes (2004) state that that local automotive component manufacturers intent on engaging in innovation activities have the cards stacked against them. First, the presence of sophisticated local competences is no guarantee that technological spill-over will be forthcoming and secondly innovation and design in global automotive production put a premium on core localities and traditional suppliers with global remits. The global automotive supply chain also suffers from constant overcapacity. As seen in the literature review on foreign ownership, foreign companies would rather internalize to protect core proprietary information build up through R&D activities and differentiated products. According to Lorentzen and Barnes (2004) automotive R&D is essentially performed by fewer and very large, powerful firms protected by considerable entry barriers.

Schumpter (1934) indicated that many types of innovation exist. If R&D activities are excluded, would other types of innovation exist in the South African automotive industry? Lorentzen and Barnes (2004) studied the technological trajectory of a handful of local component firms that stand out from the crowd in the sense that they pursue activities aimed at technological upgrading and innovation. The authors find that technological learning, namely the ability to make use of externally available knowledge, takes place in firms as well as diffusion, understood as the acquisition of technology by local firms who then engineer adaptations and modifications to suit local needs. If this leads to innovation depends on the quality of resources the acquiring firm control. Firms who learn and upgrade, and this is not limited to new know-how in a narrow sense but includes operational techniques and managerial processes, are likely to be affected differently by foreign knowledge over time. In the eight firms they studied, learning is present in all firms, all firms upgrade, only two firms categorically exclude self-driven product innovation activities, two firms have come up with innovative processes where they employ radically new techniques, different input combinations, or specific tooling arrangements primarily to obtain cost advantages and three firms have produced entirely new products for which they own the intellectual property.

For the South African components industry Lorentzen and Barnes (2004) find that upgrading relies on individual and collective technological capabilities, namely those that the individual firm possesses as well as those present upstream and downstream with beneficial effects across tiers. The innovation activities of firms cover processes and products. Product innovation is strictly excluded only if R&D is so capital-intensive as to be prohibitively costly. Where it does happen, it takes the form of downwards (into the aftermarket) or upwards re-engineering, sideways diversification, and even blue-sky development. Whether innovation trickles downward from R&D or grows upward from gradual assimilation of technologies and process improvements, differs from firm to firm

and depends, more precisely, on the relative strengths of each firm in terms of productive capacity and technological capability. Innovation in aftermarket products is generally easier and helps retain technological competences.

As for innovation in the South African catalytic converter industry, the study of Lorentzen and Barnes (2004) included one company. No other literature directed only at the South African catalytic converter industry can be found. The catalytic converter industry should have the same characteristics as the rest of the components industry. This research will however test if differences are observed.

2.4 Linking foreign ownership and innovation activities in the automotive industry.

Throughout the literature review it seems that FDI and innovation goes hand in hand. The intent for this section is to compare if this is the case for other developing nations automotive industries as well. The intention is to look at the automotive industries of China, Brazil and Thailand.

The Chinese adopted FDI investment as the main source of technological transfer in their automotive industry. In a study by Sadoi (2008) on technology transfer in automotive parts firms in China, the author confirms that the Chinese strategy in the automotive industry is to attract large MNE's to invest in China, since MNE's are the major source of technology, and to revise regulation on foreign investment in such a way which makes its attractive for the foreign enterprise to invest. This strategy is typically observed in the automobile industry development policies of the Chinese government. The policy requires MNE's to invest in advanced levels of products, production facilities, machine tools, and to invest in research and development facilities in China.

In conclusion, Sadoi (2008) states that, attracted by the huge domestic market the volume of foreign direct investment has expanded rapidly to accelerate the

development of the automotive sector in China. Government policy requiring joint venture and technology transfer conditions has played an important role in stimulating localization in the industry. Chinese automotive engineering and parts suppliers have been one of the big beneficiaries of government-led technology transfer and localization strategies. The successful implementation of the government policy helped automotive firms achieve localization in China at a rate much faster than observed in other developing nations. Government policy in China also focused directly on the development of technological capabilities in local firms whereas in other developing nations with similar goals the emphasis has been limited largely to incentives.

Looking at the Brazilian automotive industry between 1996 and 2001, the global automotive industry invested over US$20 billion in Brazil, more than in any other country in the world in that period. Moreover, the Brazilian automotive industry received a high proportion, a quarter to a third, of FDI inflows to the manufacturing sector, and vehicle production capacity grew from 2million per annum in 1997 to 3.5 million per annum in 2001. (Doctor, 2007)

The Brazilian economy, including the automotive industry, was also exposed to the impact of market liberalization and structural reform as with most of the other developing nations. For the Brazilian automotive industry the government policy was referred to as the “New Automotive Regime”. The new policy granted investors a number of incentives, under almost similar conditions as the Chinese. The only exclusion in the case of the Brazilians was that FDI did not necessarily need to be in the form of joint ventures. The Brazilian automotive industry also demanded high technology and the requirements for research and development opportunities in Brazil. International automotive companies were attracted to Brazil’s local market which showed huge potential in terms of volume. Another important factor was the location of Brazil. From Brazil, automotive industries have access to all of the South American markets.

Looking at Thailand's automotive industry the following is observed. The Thai government adopted the slogan of developing their automotive industry into "the Detroit of the East". In a study done by Busser (2008) on the Thai automotive industry the author stated that an important reason for promoting the automobile industry in Thailand, as is the case in many developing countries, is the fact that the industry harbours a broad range of technologies. It is reasoned that once a country houses these technologies, that country will have a relative strong point of departure for developing its industrial base further.

An important difference between Thailand and Detroit is the fact that American companies dominate the automobile industry in Detroit while Thailand has no car company with its own brand name. Instead Japanese companies dominate the automobile industry in Thailand as well as the production of parts and components. Thailand do not have a large enough domestic market to demand certain conditions under which FDI should happen, in order to ensure the successful transfer of technology. It is evident in the case of the Thai automotive industry that the capability to make use of FDI in the industry has not yet developed. The Thai government can only provide incentives without conditions of advanced technological development for FDI investments in their automotive industry. It is argued that without the government incentive, the automotive industry in Thailand would not exist. It does not harbour the necessary characteristics necessary for attracting FDI by itself. The domestic market is too small and the labour force lacks the technical and educational capabilities necessary to be successful in the automotive industry.

The South African automotive industry shows similarities to the Thai automotive industry. For the South African MIDP and PAA incentive, Kaggwa, Pouris and Steyn (2007) concluded that the offer of an investment incentive may not be influential enough to motivate a profit-oriented industry to invest in R&D and innovation activities. The industry has increased its investment in production equipment and tools just to produce vehicles and components to meet the

international standards, but with no visible effort to improve on R&D and innovation activities. The South African local market does not provide any incentives, in terms of volume, to demand certain conditions, under which FDI should occur.

2.5 Foreign Ownership, education and skills development.

Do higher levels of technical abilities and educated employees exist in companies with high levels of foreign ownership? Foreign companies do need these skills to operate in a foreign country. It is expected that the same levels of quality be maintained as is the case in the home industry. Many products produced in the host economy are exported back to the home industry. In the case of developing nations where the levels of education is not so high, the question is if foreign companies do invest in education for their workforce.

It is evident from the literature review on foreign ownership that MNE's look at countries where the level of education are higher. Fact is FDI occurs even in developing countries where the level of education is not high. In the conclusion of research done by Chatterji and Montagna (2008) on FDI in relation to training and absorptive capacity, the authors found that:

(i) MNEs provide on-the-job training in developing countries, thus contributing to the creation of human capital in host countries,

(ii) such training is often associated with the use of sophisticated technologies, and

(iii) the extent of MNEs investment is affected by the absorptive capacity of the host country's workforce.

The authors' model suggests that low local labour costs matched by a high absorptive capacity are particularly attractive only to those MNEs with sufficiently sophisticated technologies. This suggests that foreign companies do invest in education.

2.6 Conclusion

What influences the choice of companies producing abroad is a standard microeconomic assumption that the firms aim at maximizing profits. A company does FDI to development or expand a new market and to lower its production cost. This is obtained by using its advantages obtained through learning and upgrading over the years. Assuming the rational that firms maximize profits, the issue of where to locate becomes the question of which location allows firms to maximize profits. Certain industries choose certain developing countries because they will make more money in those countries. Many developing countries, so far protected, are now liberalizing their policies to attract FDI. These countries are in desperate need of FDI to stimulate their economies, to provide jobs to their citizens, and to attract advanced technologies associated with FDI. South Africa is such a developing country. The government has attracted FDI to South Africa through various policy incentives, hoping that this will result in R&D activity followed by advanced technology. It is believed that FDI is the carrier of advanced technology, and that once a country harbours these technologies it will result in a spill-over into other industries. For the South African automotive industry is seems that the levels of FDI did not yet result in the hoped for R&D activity. It did however brought awareness to local component firms that they must upgrade to stay competitive in the now global supply chain. Several other types of innovation were observed in the components industry. It seems that at this stage the South African automotive industry is benefitting more from its higher educated employees. In comparison to several European countries where R&D efforts are highly important to innovation outcomes, SA firms generally tend to profit far more from their higher educated employees. It points to the importance of embodied knowledge for innovation in SA. Innovation is truly a human matter that seems less dependent on formalised R&D activities in SA firms.

Chapter 3

Research Questions/Propositions/Hypotheses.

Research questions are used when a topic is new and/or under-researched and the literature does not provide solutions to the research objectives. Several studies mostly aimed at innovation activities within the South African components industry was performed before. The researcher can therefore not conclude that the topic is new or under researched. The question approach to this research will therefore not be used.

Propositions are used when the researcher proposes what the findings are likely to be. Looking at previous research results done on the topic of innovation activities within the South African automotive components industry, the outcome of this research can be predicted to be the same. The researcher is however uncertain if the results would be the same if only one sub-section of the components industry is researched. No evidence of such a research study could be found. The catalytic converter industry, although very small in relation to the total automotive components industry in terms of number of companies, did export 55 percent of the total component exports in 2007. Propositions are therefore not suitable for this research and will not be used.

Hypotheses testing would suite this research well. Quantitative research will be conducted. According to Zikmund (2003) the purpose of quantitative research is to determine the quantity or extend of some phenomenon in the form of numbers. The researcher will in collaboration with other researchers collect quantitative data within the total automotive components industry. These data will then be statistically analyzed, discussed and concluded. This research aims at concluding the following hypotheses tests:

Hypotheses Test 1:

Ho	The levels of foreign ownership in the catalytic converter industry and in the components industry ***are*** equal.
H1	The levels of foreign ownership in the catalytic converter industry and in the components industry ***are not*** equal.

Hypotheses Test 2:

Ho	The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry ***are*** equal.
H1	The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry ***are not*** equal.

Hypotheses Test 3:

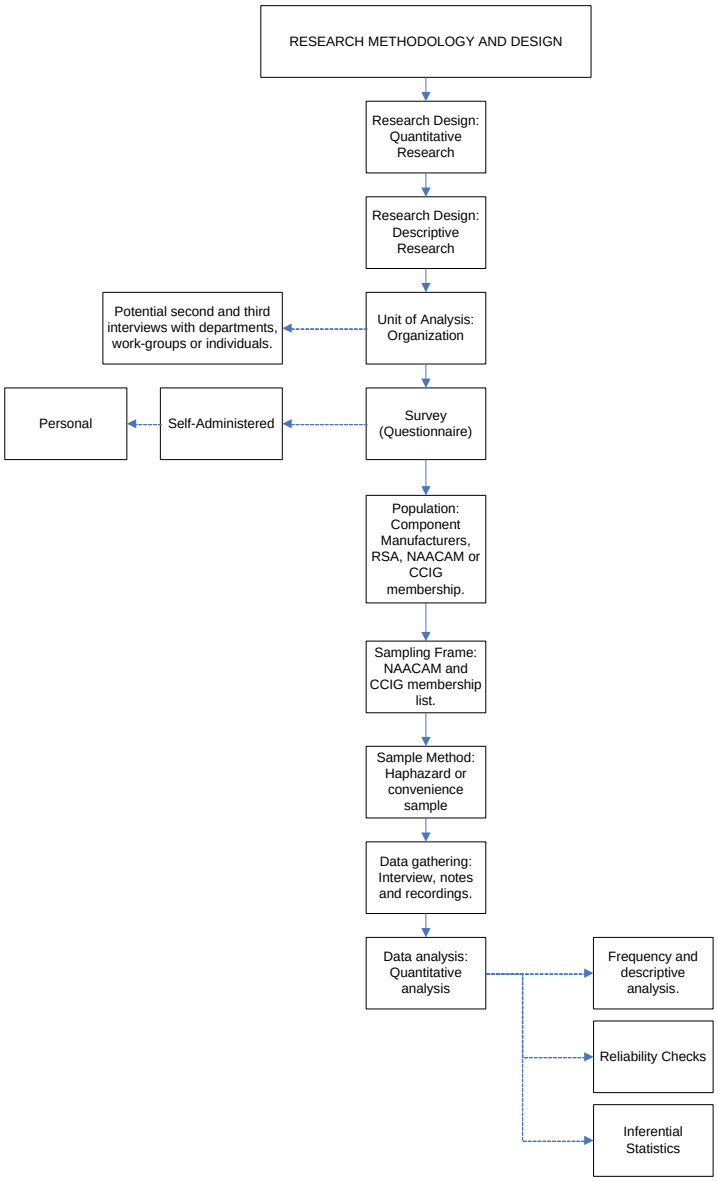
Ho	Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry ***are*** equal.
H1	Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry ***are not*** equal.

Chapter 4

Research Methodology and Design.

This research is aimed at studying innovation activities within the South African Automotive part makers industry, as part of a larger collaborative research project on innovation. In this paper specific attention will be given to the South African catalytic converter industry. Figure one provides the outline of the research methodology.

Figure 1: Outline of research methodology.



4.1 Research Design

Quantitative research will be conducted. According to Zikmund (2003) the purpose of quantitative research is to determine the quantity or extent of some phenomenon in the form of numbers. In this research the researcher will measure the quantity of foreign ownership in relation to domestic ownership. The researcher will also measure the level or extent of innovation in the targeted organizations as well as the levels of education in terms of technical, university degree and post graduate qualification. All three measures can be expressed in the form of numbers.

The research will take the form of descriptive research. According to Zikmund (2003) descriptive research describes the characteristics of a population or phenomenon. Descriptive research seeks to determine the answers to who, what, when, where and how questions. In this research the researcher will measure the "what" in terms of ownership and the "how" in terms of level or extent of innovation, and the level of education. The researcher tries to establish a relationship between ownership, education and levels of innovation. Zikmund (2003) states that frequently, descriptive research will attempt to determine "the extent" of differences in the needs, perceptions, attitudes and characteristics of subgroups. This research will study the subgroup, catalytic converter manufacturers, within the larger automotive components industry. The researcher will try to understand the characteristics driving the results of this research. The researcher will investigate the typical characteristics of a company with high levels of foreign ownership, and that of a company with low levels of foreign ownership. These characteristics will explain the results of the research and as stated by Zikmund (2003) explain the differences in the characteristics of the subgroups.

Inferential statistics is used to make an inference about a population from a sample. Hypotheses testing will be used to test the inference. According to Zikmund (2003) a hypotheses is an unproven proposition or situation that

tentatively explains certain facts or phenomena; a proposition that is empirically testable. The null hypothesis is a statement about the status quo asserting that any changes from what has been thought to be true will be due entirely to random error. The alternative is a statement indicating the opposite of the null hypothesis.

4.2 Unit of Analysis

According to Zikmund (2003), the researcher must specify whether the level of investigation will focus on the collection of data about the entire organization, department, work groups, individuals or objects.

The collaborative questionnaire that will be used refers to innovation as actions of improved goods, service, methods of manufacturing, logistics, internal management practices or methods of organizing external relations. The questionnaire further refers to innovation activities as intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of other external equipment and training. Taking this broad spectrum of definitions into consideration, innovation taking place at all the levels of the targeted organization must be captured. The focus will be on the entire organization. The questionnaire will be administered to a level of the organization that is familiar with the working of the entire organization.

4.3 Population and sampling frame.

According to Zikmund (2003) a population, or universe is any complete group of people, companies or the like that share some set of characteristics. For the purpose of this research the characteristics of the population are that the company manufactures automotive components and operates within the borders of South Africa.

Zikmund (2003) describes a sampling frame as a list of elements from which a sample can be drawn. The NAACAM (National Association of Automotive

Component and Allied Manufacturers) as well as the CCIG (Catalytic Converter Interest Group) list, lists the detail of companies in the population from which a sample will be drawn.

4.4 Sampling method

Sampling of companies on the NAACAM list was assigned in a haphazard manner and is therefore classified as non-probability sampling. According to Zikmund (2003) non-probability sampling is a sampling technique in which units of the sample are selected on the basis of personal judgement or convenience. This research forms part of a collaborative research project on innovation. The NAACAM list of companies was divided amongst all researchers participating in the collaborative study on a convenience basis. The aim for all participants in the collaborative study is to cover the total NAACAM list in a joint effort.

With specific emphasis to this research the researcher will include the CCIG list and target all the automotive catalytic converter manufacturing companies (canners) on the list. This will happen in a haphazard or convenient manner. The intention is to conduct a census on all canners because there are not many of them.

4.5 Data gathering process

The questionnaire as per Appendix A will be self-administered by the researcher to all the selected companies. The questionnaire will be distributed via e-mail to all the companies prior to the interview taking place. The interview might take the form of a personal interview, or through a discussion via telephone. The telephone discussion will take place where the questionnaire was completed remotely, to confirm the answers given. All participants in the research will be asked to sign a letter of informed consent where possible and applicable. The letter of informed consent is not deemed compulsory in the case of this research to make the data entry valid and useful, as the nature of the research is based around numbers and the entry will disappear within the larger study.

4.6 Data analysis

Zikmund (2003) refers to data analysis as the application of reasoning to understand and interpret data that has been gathered. The researcher aims for a confidence level of 95 percent, as is normally associated with management data. According to Zikmund (2003) a confidence level is a percentage that tells how confident a researcher can be about being correct. It states the long-run percentage of the time that a confidence interval will include the true population mean. The last process would then be to run inferential statistics on all applicable data. The hypothesis-test procedure goes as follow:

(i) A statistical hypothesis is determined.

(ii) Take an actual sample and calculate the sample mean.

(iii) Determine if the deviation between the obtained value of the sample mean and its expected value would have occurred by chance alone if the statistical hypothesis were true.

(iv) Test the hypothesis against the applicable significance level.

The table below explain the different approaches in analysing all gathered data.

Reference	Analysis Approach	Motivation for Approach
Hypotheses 1	Question 6 of the questionnaire. Ratio Analysis. (2 sample *t*-test)	According to Zikmund (2003) a ratio scale is a scale having absolute rather than relative quantities and possessing an absolute zero, where there is an absence of a given attribute. The analysis should be to determine if the sample mean is significantly different from the hypothesized population mean. According to Zikmund (2003) a possible test of statistical significance can be the *Z*-test if the sample is large or the *t*-test if

		the sample is small.
Hypotheses 2	Question 18 b of the questionnaire. Ratio Analysis (2 sample *t*-test)	According to Zikmund (2003) a ratio scale is a scale having absolute rather than relative quantities and possessing an absolute zero, where there is an absence of a given attribute. The analysis should be to determine if the sample mean is significantly different from the hypothesized population mean. According to Zikmund (2003) a possible test of statistical significance can be the *Z*-test if the sample is large or the *t*-test if the sample is small.
Hypotheses 3	Question 22 and question 26 of the questionnaire. Descriptive and nominal analysis (Mean, standard deviation and variance) Chi-Square test.	According to Zikmund (2003) descriptive analysis refers to the transformation of raw data into a form that will make them easy to understand and interpret; rearranging, ordering, manipulating data to provide descriptive information. Descriptive statistics are also used to describe or summarize information about the population or sample. For nominal analysis, according to Zikmund (2003) the mean refers to a measure of central tendency, the arithmetic average. The standard deviation refers to a quantitative index of

		a distributions spread or variability, the square root of the variance. The variance refers to a measure of variability or dispersion, the square root is the standard deviation. According to Zikmund (2003) the possible test of statistical significance can be the chi-square or *t*-test.

4.7 Research limitations

Descriptive research is only as good as the sample it is drawn from. The research is dependant on a large enough sample size from the sampling frame. The researcher is dependant on the data collected by all the other researchers taking part in the collaborative study.

The catalytic converter manufacturing industry is a small industry. The probability exists that the sample size might be too small even if all are included. Only eight manufacturing companies exist from which a sample can be drawn.

Chapter 5:

Results from statistical analysis

It is the researchers aim to present the statistical results for this research in relation to the three hypotheses that was established in chapter three of this research report.

5.1 Hypotheses Test 1

The levels of foreign ownership in the catalytic converter industry and in the components industry *are* equal.

5.1.1 Domestic Capital

Ho	The population mean of sample distribution one (domestic capital in the catalytic converter industry) equals the population mean of sample distribution two (domestic capital in the other components industries)
H1	The population mean of sample distribution one (domestic capital in the catalytic converter industry) does not equal the population mean of sample distribution two (domestic capital in the other components industries)

Minitab result:

Two-Sample T-Test and CI: DOMCAP (Cat), DOMCAP (Other)

	N	Mean	StDev	SE Mean
DOMCAP (Cat)	8	4.38	9.04	3.2
DOMCAP (Other)	61	48.4	47.7	6.1

Difference = mu (DOMCAP (Cat)) - mu (DOMCAP (Other))

Estimate for difference: -43.9955

95% CI for difference: (-57.7885, -30.2025)

T-Test of difference = 0 (vs. not =): T-Value = -6.38 P-Value = 0.000 DF = 59

5.1.2 Foreign Capital

Ho	The population mean of sample distribution one (domestic capital in the catalytic converter industry) equals the population mean of sample distribution two (domestic capital in the other components industries)
H1	The population mean of sample distribution one (domestic capital in the catalytic converter industry) does not equal the population mean of sample distribution two (domestic capital in the other components industries)

Minitab Result:

Two-Sample T-Test and CI: FORCAP (Cat), FORCAP (Other)

	N	Mean	StDev	SE Mean
FORCAP (Cat)	8	95.63	9.04	3.2
FORCAP (Other)	61	51.6	47.7	6.1

Difference = mu (FORCAP (Cat)) - mu (FORCAP (Other))
Estimate for difference: 43.9955
95% CI for difference: (30.2025, 57.7885)
T-Test of difference = 0 (vs not =): T-Value = 6.38 P-Value = 0.000 DF = 59

5.2 Hypotheses Test 2

The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry *are* equal.

5.2.1 Technical Education

Ho	The population mean of sample distribution one (technical education in the catalytic converter industry) equals the population mean of sample distribution two (technical education in the other components industries)
H1	The population mean of sample distribution one (technical education in the catalytic converter industry) does not equal the population mean of sample

	distribution two (technical education in the other components industries)

Minitab Result:

Two-Sample T-Test and CI: TECHEDU (Cat), TECHEDU (Other)

	N	Mean	StDev	SE Mean
TECHEDU (Cat)	8	14.9	10.4	3.7
TECHEDU (Other)	64	17.9	24.5	3.1

Difference = mu (TECHEDU (Cat)) - mu (TECHEDU (Other))

Estimate for difference: -3.00781

95% CI for difference: (-13.01853, 7.00290)

T-Test of difference = 0 (vs not =): T-Value = -0.63 P-Value = 0.537 DF = 19

5.2.2 University Education

Ho	The population mean of sample distribution one (university education in the catalytic converter industry) equals the population mean of sample distribution two (university education in the other components industries)
H1	The population mean of sample distribution one (university education in the catalytic converter industry) does not equal the population mean of sample distribution two (university education in the other components industries)

Minitab Result:

Two-Sample T-Test and CI: UNIVEDU (Cat), UNIVEDU (Other)

	N	Mean	StDev	SE Mean
UNIVEDU (Cat)	8	4.25	1.83	0.65
UNIVEDU (Other)	64	5.05	7.83	0.98

Difference = mu (UNIVEDU (Cat)) - mu (UNIVEDU (Other))

Estimate for difference: -0.804688

95% CI for difference: (-3.166651, 1.557276)

T-Test of difference = 0 (vs not =): T-Value = -0.69 P-Value = 0.496 DF = 47

5.2.3 Post Graduate Education

Ho	The population mean of sample distribution one (post graduate education in the catalytic converter industry) equals the population mean of sample distribution two (post graduate education in the other components industries)
H1	The population mean of sample distribution one (post graduate education in the catalytic converter industry) does not equal the population mean of sample distribution two (post graduate education in the other components industries)

Minitab Result:

Two-Sample T-Test and CI: POSTGRAD (Cat), POSTGRAD (Other)

	N	Mean	StDev	SE Mean
POSTGRAD (Cat)	8	1.38	1.19	0.42
POSTGRAD (Other)	64	2.46	7.73	0.97

Difference = mu (POSTGRAD (Cat)) - mu (POSTGRAD (Other))
Estimate for difference: -1.08594
95% CI for difference: (-3.18866, 1.01678)
T-Test of difference = 0 (vs not =): T-Value = -1.03 P-Value = 0.306 DF = 67

5.3 Hypotheses Test 3

Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry *are* equal.

According to Zikmund (2003) the chi-square test allows us to test for significance in the analysis of frequency distributions.

5.3.1 Product & Process Innovation in the other components industry

Step 1: Formulate the null hypotheses and determine the expected frequency of each answer

Ho: The frequency of observations where no innovation took place equals the frequency of observations where some innovation took place.

H1: The frequency of observations where no innovation took place does not equal the frequency of observations where some innovation took place.

The expected probability of innovation taking place or not taking place is fifty-fifty or 0.5.

Step 2: Determine the appropriate significance level.

The significance level is set at 0.05 as is common practice with management data.

Step 3: Calculate the chi-square statistics

Chi-Square test done with statistical software – Minitab

Frequency Table:

Description	NEWGOODS	NEWSERV	NEWMANF	NEWLOG	NEWIMP	NEWOER	Total
0 - No Innovation	38	51	25	47	31	47	**239**
1,2,3 - Some Innovation	26	13	39	17	33	17	**145**
Total	**64**	**64**	**64**	**64**	**64**	**64**	**384**

Total	Newgoods	Newserv	Newmanf	Newlog	Newimp	Newoer	Total
1	38	51	25	47	31	47	239
	39.83	39.83	39.83	39.83	39.83	39.83	
	0.084	3.130	5.524	1.289	1.959	1.289	
2	26	13	39	17	33	17	145
	24.17	24.17	24.17	24.17	24.17	24.17	
	0.139	5.160	9.105	2.125	3.229	2.125	

Total	64	64	64	64	64	64	384

Chi-Sq = 35.159, DF = 5, P-Value = 0.000

- The chi-square value = 35.159
- Degrees of freedom = 5
- From Zikmund (2003) Chi-square distribution (Table 4), at a significance level of 0.05 and 5 degrees of freedom the value is 11.070.

5.3.2 Innovation activities in other components industry

Step 1: Formulate the null hypotheses and determine the expected frequency of each answer

Ho: The frequency of observations where no innovation took place equals the frequency of observations where some innovation took place.

H1: The frequency of observations where no innovation took place does not equal the frequency of observations where some innovation took place.

The expected probability of innovation taking place or not taking place is fifty-fifty or 0.5.

Step 2: Determine the appropriate significance level.

The significance level is set at 0.05 as is common practice with management data.

Step 3: Calculate the chi-square statistics

Chi-Square test done with statistical software – Minitab

Frequency Table:

Description	INTRARAD	EXTRARAD	ACQMEQ	ACQEXKN	TRAININ	Total
0 - No	36	50	26	33	16	161
1,2,3 - Some innovation activity	28	14	38	31	48	159
Total	**64**	**64**	**64**	**64**	**64**	**320**

Total	Intrarad	Extrarad	Acqmeq	Acqexkn	Trainin	Total
1	36	50	26	33	16	161
	32.20	32.20	32.20	32.20	32.20	
	0.448	9.840	1.194	0.020	8.150	
2	28	14	38	31	48	159
	31.80	31.80	31.80	31.80	31.80	
	0.454	9.964	1.209	0.020	8.253	
Total	64	64	64	64	64	320

Chi-Sq = 39.552, DF = 4, P-Value = 0.000

- The chi-square value = 39.552
- Degrees of freedom = 5
- From Zikmund (2003) Chi-square distribution (Table 4), at a significance level of 0.05 and 4 degrees of freedom the value is 9.488.

5.3.3 Product & Process Innovation in the catalytic converter industry

Step 1: Formulate the null hypotheses and determine the expected frequency of each answer

Ho: The frequency of observations where no innovation took place equals the frequency of observations where some innovation took place.

H1: The frequency of observations where no innovation took place does not equal the frequency of observations where some innovation took place.

The expected probability of innovation taking place or not taking place is fifty-fifty or 0.5.

Step 2: Determine the appropriate significance level.

The significance level is set at 0.05 as is common practice with management data.

Step 3: Calculate the chi-square statistics

Chi-Square test done with statistical software – Minitab

Frequency Table:

Description	NEWGOODS	NEWSERV	NEWMANF	NEWLOG	NEWIMP	NEWOER	Total
0 - No Innovation	7	7	5	5	6	8	**38**
1,2,3 - Some Innovation	1	1	3	3	2	0	**10**
Total	**8**	**8**	**8**	**8**	**8**	**8**	**48**

Total	Newgoods	Newserv	Newmanf	Newlog	Newimp	Newoer	Total
1	7	7	5	5	6	8	38
	6.33	6.33	6.33	6.33	6.33	6.33	
	0.070	0.070	0.281	0.281	0.018	0.439	
2	1	1	3	3	2	0	10
	1.67	1.67	1.67	1.67	1.67	1.67	
	0.267	0.267	1.067	1.067	0.067	1.667	
Total	8	8	8	8	8	8	48

Chi-Sq = 5.558, DF = 5, P-Value = 0.352

- The chi-square value = 5.558
- Degrees of freedom = 5
- From Zikmund (2003) Chi-square distribution (Table 4), at a significance level of 0.05 and 5 degrees of freedom the value is 11.070.

5.3.4 Innovation activities in the catalytic converter industry

Step 1: Formulate the null hypotheses and determine the expected frequency of each answer

Ho: The frequency of observations where no innovation took place equals the frequency of observations where some innovation took place.

H1: The frequency of observations where no innovation took place does not equal the frequency of observations where some innovation took place.

The expected probability of innovation taking place or not taking place is fifty-fifty or 0.5.

Step 2: Determine the appropriate significance level.

The significance level is set at 0.05 as is common practice with management data.

Step 3: Calculate the chi-square statistics

Chi-Square test done with statistical software – Minitab

Frequency Table:

Description	INTRARAD	EXTRARAD	ACQMEQ	ACQEXKN	TRAININ	Total
0 - No	8	8	4	4	1	25
1,2,3 - Some innovation activity	0	0	4	4	7	15
Total	**8**	**8**	**8**	**8**	**8**	**40**

Total	Intrarad	Extrarad	Acqmeq	Acqexkn	Trainin	Total
1	8	8	4	4	1	25
	5.00	5.00	5.00	5.00	5.00	
	1.800	1.800	0.200	0.200	3.200	
2	0	0	4	4	7	15
	3.00	3.00	3.00	3.00	3.00	
	3.000	3.000	0.333	0.333	5.333	
Total	8	8	8	8	8	40

Chi-Sq = 19.200, DF = 4, P-Value = 0.001

- The chi-square value = 19.200
- Degrees of freedom = 4
- From Zikmund (2003) Chi-square distribution (Table 4), at a significance level of 0.05 and 4 degrees of freedom the value is 9.488.

5.4 Summary of hypothesis testing:

5.1 Hypotheses Test 1 - The levels of foreign ownership in the catalytic converter industry and in the components industry *are* equal.	
5.1.1 Domestic Capital	
P-Value	0.000
Hypothesis Outcome	Reject Null Hypothesis
5.1.2 Foreign Capital	
P-Value	0.000
Hypothesis Outcome	Reject Null Hypothesis
5.2 Hypotheses Test 2 - The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry *are* equal.	
5.2.1 Technical education	
P-Value	0.537
Hypothesis Outcome	Accept Null Hypothesis
5.2.2 University education	
P-Value	0.496
Hypothesis Outcome	Accept Null Hypothesis
5.2.3 Post graduate qualification	
P-Value	0.306
Hypothesis Outcome	Accept Null Hypothesis
5.3 Hypotheses Test 3 - Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry *are* equal.	

5.3.1 Product & Process Innovation in the other components industry	
Chi-square value	35.159
Degrees of freedom	5
Tabular chi-square value at a significance level of 0.05	11.070
P-Value	0.000
Hypothesis Outcome	Reject Null Hypothesis
5.3.2 Innovation activities in other components industry	
Chi-square value	39.552
Degrees of freedom	5
Tabular chi-square value at a significance level of 0.05	9.488
P-Value	0.000
Hypothesis Outcome	Reject Null Hypothesis
5.3.3 Product & Process Innovation in the catalytic converter industry	
Chi-square value	5.558
Degrees of freedom	5
Tabular chi-square value at a significance level of 0.05	11.070
P-Value	0.352
Hypothesis Outcome	Accept Null Hypothesis
5.3.4 Innovation activities in the catalytic converter industry	
Chi-square value	19.200
Degrees of freedom	4
Tabular chi-square value at a significance level of 0.05	9.488
P-Value	0.001
Hypothesis Outcome	Reject Null Hypothesis

Chapter 6

Discussion of results

6.1 Hypotheses Test 1

The levels of foreign ownership in the catalytic converter industry and in the components industry *are* equal.

As stated by Kaggwa, Pouris and Steyn (2007) in the long run it is the investments in R&D and the subsequent potential to innovate that is likely to determine industry competitiveness. Foreign ownership carries with it advanced technology. (Sadoi (2008), Doctor (2007), Busser (2008), Lorentzen and Barnes (2004)). Taking this into consideration and looking at the phenomenal growth in exports of the catalytic converter industry, it is important to test this statistically.

6.1.1 Domestic Capital

This test was performed to establish if higher levels of domestic ownership would be detected in the components industry in relation to the catalytic converter industry. A two sample t-test was performed to test if the population mean of sample distribution one (domestic capital in the catalytic converter industry) equals the population mean of sample distribution two (domestic capital in the other components industries). In order to accept the null hypothesis the p-value must be greater than 0.05. The calculated p-value was 0.0000, indicating that the means of the two populations are not equal. The mean for domestic capital in the components industry is higher than the mean for the catalytic converter industry. This confirms that lower levels of domestic ownership are detected in the catalytic converter industry than in the components industry.

6.1.2 Foreign Capital

This test was performed to establish if higher levels of foreign ownership would be detected in the catalytic converter industry in relation to the components industry. A two sample t-test was performed to test if the population mean of

sample distribution one (foreign capital in the catalytic converter industry) equals the population mean of sample distribution two (foreign capital in the other components industries). In order to accept the null hypothesis the p-value must be greater than 0.05. The calculated p-value was 0.0000, indicating that the means of the two populations are not equal. The mean for foreign capital in the components industry is higher than the mean for foreign capital in the catalytic converter industry. This indicates that statistically higher levels of foreign ownership are also detected in the components industry than in the catalytic converter industry.

6.1.3 Concluding hypothesis test 1

Conflicting information emerges in the two tests. If looking only at the test for domestic capital and seeing that the components industry shows more levels of domestic ownership one would concluded that component manufacturers would therefore have less foreign ownership. This however does not proof the statement. A test must be performed. The outcome was that the components industry also shows higher levels of foreign ownership than the catalytic converter industry. The small sample size available on the catalytic converter industry might have an influence on the result. Whatever the reasons, the null hypothesis must be rejected. There is no statistical evidence that foreign ownership in the catalytic converter industry is greater than in the components industry.

6.2 Hypotheses Test 2

The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry *are* equal.

Bakker, Oerlemans and Pretorius (2008) state that in comparison to several European countries where R&D efforts are highly important to innovation outcomes, SA firms generally tend to profit far more from their higher educated

employees. It points to the importance of embodied knowledge for innovation in SA. Innovation is truly a human matter that seems less dependent on formalised R&D activities in SA firms. Taking this into consideration and looking at the phenomenal growth of the catalytic converter industry over the last few years it is important to see if levels of education are high in relation to the components industry.

6.2.1 Technical Education

This test was performed to see if more technically qualified employees exist within the catalytic converter industry in relation to the component industry. A two sample t-test was performed to test if the population mean of sample distribution one (technical education in the catalytic converter industry) equals the population mean of sample distribution two (technical education in the other components industries). In order to accept the null hypothesis the p-value must be greater than 0.05. The calculated p-value was 0.537, indicating that the means of the two populations are equal. The mean for technical education in the catalytic converter industry is slightly higher than that of the components industry, but statistically they are equal. The level of technical education in the catalytic converter industry is equal to the level of technical education in the components industry.

6.2.2 University Education

This test was performed to see if more university qualified employees exist within the catalytic converter industry in relation to the component industry. A two sample t-test was performed to test if the population mean of sample distribution one (university education in the catalytic converter industry) equals the population mean of sample distribution two (university education in the other components industries). In order to accept the null hypothesis the p-value must be greater than 0.05. The calculated p-value was 0.496, indicating that the means of the two populations are equal. The mean for university education in the catalytic converter industry is slightly lower than that of the components

industry, but statistically they are equal. The level of university education in the catalytic converter industry is equal to the level of university education in the components industry.

6.2.3 Post Graduate Education

This test was performed to see if more post-graduate qualified employees exist within the catalytic converter industry in relation to the component industry. A two sample t-test was performed to test if the population mean of sample distribution one (post-graduate education in the catalytic converter industry) equals the population mean of sample distribution two (post-graduate education in the other components industries). In order to accept the null hypothesis the p-value must be greater than 0.05. The calculated p-value was 0.306, indicating that the means of the two populations are equal. The mean for post-graduate education in the catalytic converter industry is lower than that of the components industry, but statistically they are equal. The level of post-graduate education in the catalytic converter industry is equal to the level of post-graduate education in the components industry.

6.2.4 Concluding hypothesis test 2

No difference in the level of education of employees working in the catalytic converter industry or in the components industry was observed. This however do not therefore assume that this do not contribute to the phenomenal growth observed in the catalytic converter industry. The findings of Bakker, Oerlemans and Pretorius (2008) can well be true, and both benefit from levels of education. The findings of the test only indicate that there is no statistical difference between the two.

6.3 Hypotheses Test 3

Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices,

new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry *are* equal.

Schumpter (1934) indicated that many types of innovation exist. If R&D activities are excluded, would other types of innovation exist in the South African automotive industry? Lorentzen and Barnes (2004) studied the technological trajectory of a handful of local component firms that stand out from the crowd in the sense that they pursue activities aimed at technological upgrading and innovation. The authors find that technological learning, namely the ability to make use of externally available knowledge, takes place in firms as well as diffusion, understood as the acquisition of technology by local firms who then engineer adaptations and modifications to suit local needs. If this leads to innovation depends on the quality of resources the acquiring firm control. Firms who learn and upgrade, and this is not limited to new know-how in a narrow sense but includes operational techniques and managerial processes, are likely to be affected differently by foreign knowledge over time. In the eight firms they studied, learning is present in all firms, all firms upgrade, only two firms categorically exclude self-driven product innovation activities, two firms have come up with innovative processes where they employ radically new techniques, different input combinations, or specific tooling arrangements primarily to obtain cost advantages and three firms have produced entirely new products for which they own the intellectual property.

6.3.1 Product & Process Innovation in the other components industry

This test was performed to see if the frequency of observations where no product and process innovation took place equals the frequency of observations where some product and process innovation took place in the other components industry. A chi-square test was performed to test these frequencies. In order to accept the null hypothesis the calculated chi-square value must be lower than the tabular chi-square value or the p-value must be greater than 0.05. The

significance level at which the chi-square test was performed is 0.05. The calculated p-value was 0.000. The calculated chi-square value is 35.159, which is higher than the tabular chi-square value of 11.070 at five degrees of freedom. If the tabular chi-square value of 11.070 is lower than the calculated chi-square value, the null hypotheses is rejected. From the statistical program with P=0.000 it also suggest that the null hypotheses must be rejected. The frequency of observations where no product and process innovation took place does not equal the frequency of observations where some product and process innovation took place. The probability of no product and process innovation taking place in the other components industries is greater than the probability that some product or process innovation taking place.

6.3.2 Innovation activities in other components industry

This test was performed to see if the frequency of observations where no innovation activities took place equals the frequency of observations where some innovation activities took place in the other components industry. A chi-square test was performed to test these frequencies. In order to accept the null hypothesis the calculated chi-square value must be lower than the tabular chi-square value or the p-value must be greater than 0.05. The significance level at which the chi-square test was performed is 0.05. The calculated p-value was 0.000. The calculated chi-square value is 39.552, which is higher than the tabular chi-square value of 9.488 at five degrees of freedom. If the tabular chi-square value of 9.488 is lower than the calculated chi-square value, the null hypotheses is rejected. From the statistical program with P=0.000 it also suggest that the null hypotheses must be rejected. The frequency of observations where no innovation activities took place does not equal the frequency of observations where some innovation activities took place. The probability of no innovation activities taking place in the other components industries is greater than the probability that some innovation activities taking place.

6.3.3 Product & Process Innovation in the catalytic converter industry

This test was performed to see if the frequency of observations where no product and process innovation took place equals the frequency of observations where some product and process innovation took place in the catalytic converter industry. A chi-square test was performed to test these frequencies. In order to accept the null hypothesis the calculated chi-square value must be lower than the tabular chi-square value or the p-value must be greater than 0.05. The significance level at which the chi-square test was performed is 0.05. The calculated p-value was 0.352. The calculated chi-square value is 5.558, which is lower than the tabular chi-square value of 11.070 at five degrees of freedom. If the tabular chi-square value of 11.070 is higher than the calculated chi-square value, the null hypotheses is accepted. From the statistical program with P=0.352 it also suggest that the null hypotheses must be accepted. The frequency of observations where no product and process innovation took place equals the frequency of observations where some product and process innovation took place. The probability of observing some product or process innovation taking place in the catalytic converter industries is equal to the probability that no product or process innovation takes place.

6.3.4 Innovation activities in the catalytic converter industry

This test was performed to see if the frequency of observations where no innovation activities took place equals the frequency of observations where some innovation activities took place in the catalytic converter industry. A chi-square test was performed to test these frequencies. In order to accept the null hypothesis the calculated chi-square value must be lower than the tabular chi-square value or the p-value must be greater than 0.05. The significance level at which the chi-square test was performed is 0.05. The calculated p-value was 0.001. The calculated chi-square value is 19.200, which is higher than the tabular chi-square value of 9.488 at five degrees of freedom. If the tabular chi-square value of 9.488 is lower than the calculated chi-square value, the null

hypotheses is rejected. From the statistical program with P=0.001 it also suggest that the null hypotheses must be rejected. The frequency of observations where no innovation activities took place does not equal the frequency of observations where some innovation activities took place. The probability of no innovation activities taking place in the catalytic converter industries is greater than the probability that some innovation activities taking place.

6.3.5 Concluding hypothesis test 3

The results of all the tests done indicate that the probability that product and process innovation occur within the catalytic converter industry is higher than in the components industry. All other tests turn out to be negative. Although the finding was made, the researcher cannot with certainty state that this is giving the catalytic converter industry the edge above other component manufacturers. It is suggested that further research be conducted to investigate exactly what types of product and process innovation is taking place within the catalytic converter industry and if this is resulting in the growth see over the past few years.

Chapter 7

Conclusion

Theory has formulated the conditions under which industry growth can occur in an automotive components industry in a developing country. What an automotive industry in a developing country need is advanced technology. According to Zhu, Xu and Lundin (2006) sustainable industry competitiveness is only achieved through advanced technology. The Chinese and Brazilian automotive industries are good examples, where advanced technology has benefitted their automotive industry as a whole. (Sadoi (2008), Doctor (2007)) FDI is the carrier of advanced technology. FDI occurs because MNE's choose to expand as a result of capabilities they have build up over the years, that being advanced technology obtained from R&D activity, differentiated products and advanced marketing and management skills. What influences the choice of companies producing abroad is aimed at maximizing their profits. Developing nations strive to attract FDI, as it is believed that once a country harbours these technologies, it will result in a spill-over into other industries. There are several reasons why MNE's invest in certain countries. MNE's are attracted by the size and future prospects of the domestic market, the quality and cost of the domestic workforce and by policy incentives financially beneficial to them.

Spill-over of technology is however not a guarantee. It depends on the absorptive capacity of companies receiving this technology. Absorptive capacity refers to the organizations ability to recognize the value of new, external information, assimilate it, and apply it for competitive advantage. When formal R&D activities in the domestic market are not possible or feasible, because of cost constraints, domestic industries can upgrade through learning and diffusion. Not all innovation activities are dependent on R&D activities. Schumpter (1934) defined five types of innovation. These are:

(vi) introduction of a new product or a qualitative change in an existing product,

(vii) process innovation new to an industry,

(viii) opening of a new market,

(ix) the development of new sources of supply for raw material and

(x) other inputs and changes in the industrial organisation.

The research of Lorentzen and Barnes (2004) has identified the conditions in the local components industry under which innovation can take place. According to the authors what matters is:

(v) the availability of foreign capital,

(vi) the presence of local capabilities,

(vii) the industry must be located in a core group of technology-leading countries, and

(viii) Company involvement and association with high technology clusters.

Lorentzen and Barnes (2004) found that South African automotive component manufacturers do innovate and do upgrade. Innovation in the South African automotive perspective relies on the level of education in the South African automotive industry. Bakker, Oerlemans and Pretorius (2008) state that in comparison to several European countries where R&D efforts are highly important to innovation outcomes, SA firms generally tend to profit far more from their higher educated employees.

The question is how do the level of foreign ownership, the level of innovation and the level of education translate to the South African catalytic converter industry? This research investigated if higher levels foreign ownership, innovation activities and levels of education could be detected in the South African catalytic converter industry in comparison to the South African automotive components industry. In chapter one of this research it was clearly stated that the catalytic converter industry exported 55 percent of all component exports in South Africa. It is important to understand why the industry was able to achieve this. Learning from the catalytic converter industry might be beneficial to other industry sectors of

South Africa. The analysis of the data did however not turn up conclusive evidence that the catalytic converter industry is in any way different from the components industry in terms of levels of foreign ownership, education and innovation. The only slight difference that was measured was that the probability of some product and process innovation taking place in the catalytic converter industry is higher than the probability that some product and process innovation taking place in the components industry. This is not enough proof to differentiate the two industries completely from each other. Many questions remain unanswered on what exactly drives the success of the catalytic converter industry. Further in-depth qualitative as well as quantitative studies must be conducted to understand the South African catalytic converter industry in full.

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Appendices

Appendix A: Letter of informed Consent.

I am conducting research on innovation activities within the South African automotive component manufacturing industry as part of a larger collaborative study. I am trying to find out if companies within the South African catalytic converter industry show more levels of foreign ownership in comparison to other members on the NAACAM list, and if companies within the South African catalytic converter industry show more levels of innovation in comparison to the other members on the NAACAM list?

The interview is expected to last for about two hours. Your participation is voluntary and you can withdraw at any time without penalty. All data will be kept confidential. If you have any concerns please feel free to contact me on or my research supervisor:

Researcher's Detail:
Kobus de Klerk
E-mail: kobus.de.klerk@cummins.com
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Research Supervisor Detail:
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Main Tel: +27 11 771 4000
Direct Tel: +27 11 771 4205
Cell: +27 83 256 7140
E-mail: beyera@gibs.co.za

Signature of participant :_____

Date :_____

Signature of researcher:_____

Date:_____

Appendix B: Consistency Matrix

Title: Do companies with high levels of foreign ownership innovate more? – Explaining the phenomenal growth of the South African catalytic converter industry.

Proposition/Questions/ Hypotheses	**Literature Review**	**Data Collection Tool**	**Analysis**
Hypothesis 1: The levels of foreign ownership in the catalytic converter industry and in the components industry ***are*** equal.	Kaggwa, Pouris and Steyn (2007) Sadoi (2008) Doctor (2007) Busser (2008) Lorentzen and Barnes (2004)	Question 6	Ratio Analysis (2 sample *t*-test). The analysis should be to determine if the sample mean is significantly different from the hypothesized population mean.
Hypotheses 2: The proportion of employees in terms of education with specific reference to a technical education or training, a university degree or post graduate studies in the catalytic converter industry and in the components industry ***are*** equal.	Bakker, Oerlemans and Pretorius (2008)	Question 18 b	Ratio Analysis (2 sample *t*-test). The analysis should be to determine if the sample mean is significantly different from the hypothesized population mean.

Hypotheses 3: Innovation activities within the South African catalytic converter industry in terms of improved goods, improved service, improved methods of manufacturing, improved logistics, new internal management practices, new methods of organising external relations, intramural R&D, extramural R&D, acquisition of machinery and equipment, acquisition of external knowledge and training in the catalytic converter industry and the components industry ***are*** equal.	Schumpter (1934) Lorentzen and Barnes (2004)	Question 22 and 26	Chi-Square test. A test that statistically determines significance in the analysis of frequency distributions.

Appendix C: List of Interview Companies assigned to researcher

COMPANY	CONTACT DETAILS
AUTOMOTIVE LEATHER COMPANY	
Rosslyn Plant &	Francois Barnard,
Head Office	Chief Executive Officer
Automotive Supplier Park	e-mail: francois@alc.co.za
30 Helium Road, Rosslyn	Grant Thorpe, Managing Director
PO Box 911-1103	e-mail: grantt@alc.co.za
Rosslyn, 0200	Uhland Müller, Commercial Director
	e-mail: uhland@alc.co.za
	Tel: +27 (0)12 564 3200
	Website: www.alc.co.za
RIETER FELTEX AUTOMOTIVE (Pty) Ltd	
Automotive Supplier Park	Robert Gooch, General Manager
30 Helium Road	Cell: +27 (0)82 905 9958
Rosslyn, 0200	e-mail: robertg@rieterfeltex.co.za
PO Box 911-3537	Marietjie Viljoen, Sales & Marketing Manager
Rosslyn, 0200	Cell: +27 (0)82 456 6527
	e-mail: marietjiev@rieterfeltex.co.za
	Tel: +27 (0)12 564 3100
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	Website: www.feltex.co.za
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AutoTube Manufacturing – A Subsidiary of Formex Industries (Pty) Ltd	
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Wadeville, 1422
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D. van der Walt, R&D Director

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Appendix D: Copy of Questionnaire

CIRCLE

100
1908 - 2008

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA
Graduate School of Technology Management

QUESTIONNAIRE FOR FIRMS

"INNOVATION-BASED STRATEGIES FOR GLOBALIZATION"

Questionnaire for "AUTOMOTIVE COMPONENT"

(SOUTH AFRICA)

Person that makes the interview_____

Date of the interview_____

NOTE: Please answer all questions in relation to the status and activities of your unit in 2007

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

I. COMPANY BACKGROUND

1. Company name _____

2. Is this unit....

☐ A single plant firm

☐ Part of an enterprise group[i] . If part of an enterprise group, this unit is

☐ The head office ☐ A subsidiary

In which country is the head office of your group located?_____

If your unit is part of an enterprise group, please answer all subsequent questions in relation to this plant in SOUTH AFRICA only.

Do not include results from parent or other enterprises outside of SOUTH AFRICA

3. Year of establishment in South Africa _____

4. Location city of this unit _____

5. Web site _____

6. Ownership

☐ Percentage of domestic capital _____%

☐ Percentage of foreign capital _____%

7. Number of employees (average full-time equivalent for 2007)

☐ 1-9 ☐ 50-99 ☐ 250-499 ☐ 1000-2499

☐ 10-49 ☐ 100-249 ☐ 500-999 ☐ More than 2500

8. Please indicate the total sales (in 2007)

Estimation of total sales in RAND _____

Or, alternatively[ii]:

☐ Less than 2 million US$ ☐ Between 10-50 million US$ ☐ More than 100 million US$

☐ Between 2-10 million US$ ☐ Between 50-100 million US$

9. Please indicate the estimated percentage of your company's sales according to the following categories:

	% sales
Products **manufactured by your unit** according to design specifications provided by external buyers (*Original Equipment Manufacturing – OEM*)	
Products **developed and designed by your unit according to performance requirements of buyers** (*Original Design Manufacturing – ODM*)	
Products **developed and designed by your unit** and sold under your **own brand**	

(*Original Brand Manufacturing – OBM*)	
Others (please describe)	

10. a Please indicate the destinations of your sales in 2007 (estimated percentage on total sales)

Destination	**% sales**
Domestic market	
North America (US and Canada)	
Western Europe[iii]	
Africa (except domestic)	
Other, please specify_____	
	100%

10. b Click here ☐ if you estimate that more than 50% of your domestic sales are further exported to international markets

11. Please indicate the origin of suppliers in 2007 (estimated percentage on total purchases)

Origin	% purchases
Domestic market	
North America (US and Canada)	
Western Europe[iv]	
Africa (except domestic)	
Other, please specify_____	
	100%

12. Please indicate to which segments in the automotive industry you supply your main product.

Light vehicles:

☐ Passenger cars
☐ Commercial vehicles

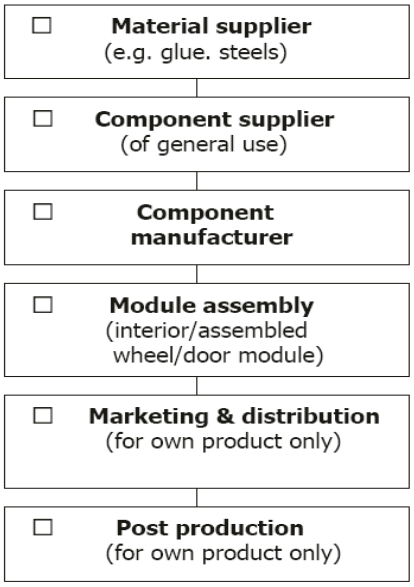
High commercial vehicles:

☐ Medium-heavy commercial vehicles
☐ Heavy trucks
☐ Buses and coaches

13. Please describe the highest value product, process or activity of your unit (2007)[v]

14. a. In the automotive component industry, which of these activities in the value chain did your unit perform in 2007? (Tick each box in the graph where your unit was involved)

Graph I: AUTOMOTIVE COMPONENT INDUSTRY VALUE CHAIN



14. b. As a supplier of automotive components, please indicate if you are:

☐ First tier supplier ☐ Second tier supplier ☐ Third tier supplier ☐ Other _____

II. STRATEGY TO ACCESS LOCAL AND FOREIGN MARKETS

15. Please indicate which strategy is mainly being used to access each of the markets:
(mark with a X all that apply)

	Quality[vi]	Cost[vii]	New products or services	Strategic partnership
Access domestic market	☐	☐	☐	☐
Access markets in other developing countries[viii]	☐	☐	☐	☐
Access other markets in industrialized countries	☐	☐	☐	☐

III. RESOURCES

16. a. Is your machinery and equipment behind or ahead the average of the industry in South Africa?

☐ Ahead ☐ Behind ☐ Average ☐ Not known

b. For how many years (ahead or behind)? ____

17. How many patents per employee did your unit register in 2007? _____

18. In 2007, what was the estimated proportion of employees in each of the following categories?

a. By position	**%**
Shop floor	
Supporting staff[ix]	
Managers	

b. By education	**%**
Technical education/training	
University degree	
Postgraduate studies	

19. Does your unit employ any of the following systems of production organization? (check all that apply)

☐ Quality control systems
☐ Just in time
☐ Continuous improvement
☐ Quality circles, team work
☐ Internal manuals
☐ Other (please specify) _____

20. Does your unit have any quality certification? If so, which one?

☐ ISO
☐ Other, please specify_____
☐ Other, please specify_____

21. Do you have an R&D department?

☐ No ☐ Yes, how many employees in the R&D dept as a percentage of total staff?_____ %

IV. TYPE AND IMPORTANCE OF INNOVATION

Product innovation[x] and Process innovation[xi]

22. During 2007, did your unit introduce any of the following innovations? If you did not, leave the rows blank. If you did, please put a cross under one of the three columns indicating the degree of novelty		New to the world[xii]	New to domestic market[xiii]	New to the firm[xiv]
Product	**P1.** New or significantly **improved goods**[xv].			
	P2. New or significantly **improved services**.			
Process	**PR1.** New or significantly **improved methods** of manufacturing[xvi]			
	PR2. New or significantly **improved logistics**[xvii]			
Organizational	**O1. New internal management practices**[xviii]			
	O2. New methods of organising external relations[xix]			

23. Which one of the product/process/organizational innovations selected on the previous question 22 **had the most significant impact**[xx] **on your unit performance during 2007?** (Please indicate the code P1, P2…..)

_____

24. For the most important innovation for your unit (as selected on question 23) **please indicate who contributed mainly to its development.** (Select the most appropriate option)

- ☐ Mainly your unit
- ☐ Your unit together with other companies
- ☐ Your unit together with a university or research center
- ☐ Other (please specify)_____

25. Please indicate if this innovation (as selected on question 23) **had an impact on your main strategies to access international or domestic markets**. (Check all that apply)

- ☐ It contributed to increase the quality of our products or services
- ☐ It contributed to reduce the costs of manufacturing our products or supplying our services
- ☐ It helped improving our delivery time
- ☐ As a consequence, we developed new products or services
- ☐ Other, please specify

26. Look at the following list of innovation activities. Did your company engage in any of those in 2007? If you did not, leave the rows blank. If you did, please indicate with a cross whether the activity was conducted **mainly** locally, domestically or internationally.	**Local**	**Domestic**	**International**
Intramural R&D[xxi]			
Extramural R&D[xxii]			
Acquisition of machinery and equipment[xxiii]			
Acquisition of other external knowledge[xxiv]			
Training[xxv]			

V. LINKAGES AND CHANNELS

Sources of technology and knowledge

27. Were the following sources of technology and knowledge important for your product/process innovation developed in 2007? If not, leave the rows blank. If yes, please indicate with a cross whether the sources were **mainly** local, domestic or international	**Local**	**Domestic**	**International**
Existing employees (excluding returnees from abroad)			
Existing employees who are returnees from abroad			
Suppliers			
Clients			
Competitors			
Consultancy companies			
Universities			

Government[xxvi]			
Other (please specify)_____			

Content of the collaboration

28. For companies that collaborated with local, domestic or international universities or research centers in 2007, which of these following activities have been important for your unit? (Mark with a X all that apply)	**Local**	**Domestic**	**International**
Training			
Research activities (R&D)			
Other (please specify)_____			

29. For the following transactions with other firms please indicate if in 2007 they took place mainly locally, domestically or internationally. (Please put a cross under one of the three columns)	**Local**	**Domestic**	**International**
Acquisition of inputs			
Acquisition of machinery			
Outsourcing			
Research collaboration			
Other (please specify)_____			

30. For companies that benefited in 2007 from any of the following supporting schemes to foster innovation or technology dissemination, please indicate which of them have been important to support your company's innovation strategies. (Mark with a X all that apply)

	Supporting schemes from		
	From local government	From national government	International funding
Tax incentives			
Funds to develop new products and acquire technology			
Export support[xxvii]			
Information on technological opportunities			
Other (please specify)			

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UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

THANK YOU VERY MUCH FOR YOUR PARTICIPATION. WE ARE VERY GRATEFUL!

Person we should contact if there are any queries regarding the form (please fill the form or attach business card):

Name: _____
Job title: _____
Organisation: _____
Phone: _____
Fax: _____
E-mail: _____

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[i] A group consists of two or more legally defined enterprises under common ownership. Each enterprise in the group may serve different markets, as with national or regional subsidiaries, or serve different product markets. The head office is also part of an enterprise group.
[ii] Rand should be converted in US dollar on the basis of 31st December 2007 rate.
[iii] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.
[iv] Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovenia, Slovakia, Switzerland, Turkey, Spain, Sweden and the United Kingdom.
[v] By highest value product or process we refer to the most important one in terms of sales, price per unit or volume.
[vi] Better quality than your competitors in that market.
[vii] Lower costs than your competitors in that market.
[viii] Asia, Africa, Latin America etc.
[ix] Accounting, financial, administrative, etc.
[x] A product innovation is the market introduction of a new good or service or a significantly improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems. The innovation (new or improved) must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises.
[xi] A process innovation is the implementation of a new or significantly improved production process, distribution method, or support activity for your goods or services. The innovation (new or improved) must be new to your enterprise, but it does not need to be new to your sector or market. It does not matter if the innovation was originally developed by your enterprise or by other enterprises. Exclude purely organizational innovations.
[xii] Your enterprise introduced a new or significantly improved good or service onto the global market before your competitors.
[xiii] Your enterprise introduced a new or significantly improved good or service onto the domestic market before your competitors (it may have already been available in other markets).
[xiv] Your enterprise introduced a new or significantly improved good or service that was already available from your competitors in your market.
[xv] Exclude the simple resale of new goods purchased from other enterprises and changes of a solely aesthetic nature.
[xvi] Include new methods of producing goods or services.
[xvii] Include delivery or distribution methods for your inputs, goods or services.

[xviii] For example new business practices for organizing work or procedures, new knowledge management systems, marketing for innovative products and services, new method of workplace organization.
[xix] For example with other firms or public institutions (i.e. first use of alliances, partnerships, outsourcing or sub-contracting, etc.)
[xx]The most important impact in terms of sales/export etc.
[xxi] Creative work undertaken within your enterprise to increase the stock of knowledge and its use to devise new and improved products and processes (including software development).
[xxii] Same activities as above, but performed by other companies (including other enterprises within your group) or by public or private research organisations and purchased by your enterprise.
[xxiii] Acquisition of advanced machinery, equipment and computer hardware or software to produce new or significantly improved products and processes.
[xxiv] Purchase or licensing of patents and non-patented inventions, know-how, and other types of knowledge from other enterprises or organisations.
[xxv] Internal or external training for your personnel specifically for the development and/or introduction of new or significantly improved products and processes (that is, training related to new products or processes, not training in general).
[xxvi] For Government we mean local/provincial/national departments.
[xxvii] Including attendance to fairs, demonstrations, etc.