DURBAN UNIVERSITY OF TECHNOLOGY

THE USE OF INNOVATIVE STRATEGIES BY AUTOMOTIVE COMPONENT MANUFACTURERS IN GAUTENG

by

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DECLARATION

I, Xola Qhogwana, declare that the work that I present in this dissertation is based on my own research and that I have not submitted it in part or in full to any other institution of higher learning to obtain an academic qualification.

…… ……

Xola Qhogwana Date

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ABSTRACT

The automotive industry is the third largest sector in the South African economy and it plays such an important role in the economy, that it is often viewed used as a barometer of the health of the economy. Despite the relatively large number of automotive component manufacturers (ACMs) in South Africa, manufacturing a wide range of automotive components, and the incentives offered by the government to increase the local content of vehicles manufactured in the country, the majority of vehicle manufacturers as well as after-market wholesalers and retailers in South Africa source a greater proportion of their automotive components from foreign suppliers. This may be due to a number of reasons, and in this regard, this study investigated the nature and extent to which ACMs in Gauteng, South Africa, used innovative strategies to remain competitive.

A quantitative research design was used, and a self-administered questionnaire was sent to all of the ACMs located in Gauteng. Some of the main findings from the study was that only 48.9% of the respondents had a Research and Development (R&D) department; ACMs ranked their clients, who include motor vehicle manufacturers and original equipment manufacturers, as the most important source of innovation, with existing employees being ranked second, suppliers ranked third, and competitors ranked fourth. The importance of a highly skilled workforce was highlighted by the finding that almost three quarters of the respondents agreed with the statement that new ideas and suggestions from employees had been implemented.

Although the local motor vehicle manufacturers purchase most of the automotive components from ACMs located outside South Africa, the finding that 82% of the ACMs surveyed have been in operation for more than 10 years, with 72% of these organisations in operation for more than 15 years, indicates that most local ACMs are financially profitable and have adapted to global competition.

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ACMs	Automotive Component Manufacturers
AIS	Automotive Investment Scheme
APDP	Automotive Production and Development Programme
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CAE	Computer Aided Engineering
EBS	Electronic Brainstorming Software
EDI	Electronic Data Interchange
ISO	International Standards Organisation
H&MCV	Heavy and Medium Commercial Vehicle
JIT	Just In Time
LCV	Light Commercial Vehicle
LM	Lean Manufacturing
MCEP	Manufacturing Competitiveness Enhancement Programme
MIDP	Motor Industry Development Programme
MNC	Multinational Corporations
NAACAM	National Association of Automotive Component and Allied Manufacturers
OE	Original Equipment
OES	Original Equipment Supplier

OEM	Original Equipment Manufacturer
OECD	Organisation for Economic Co-operation and Development
QA	Quality Assurance
R&D	Research and Development
SARS	South African Revenue Service
SMEs	Small and Medium Enterprises
SPSS	Software Package for Social Sciences
TS	Technical Specification
TPS	Total Production Systems

TABLE OF CONTENTS

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 Introduction

This chapter presents an overview of the study, and, *inter alia*, the background to the study is discussed, the research problem is identified, and the aim and objectives of the study are stated. Thereafter, the research methodology and design adopted for this study, as well as the structure of the dissertation are briefly outlined.

1.2 Background to the study

The post-apartheid removal of South Africa's trade barriers, combined with the effects of globalisation, have created both advantages and disadvantages for the country as well as automotive component manufacturers (ACMs) located in South Africa. Increased participation in the global market means that firms have also become increasingly subject to fierce global competition (Barnes and Kaplinsky 2000). Despite the relatively large number of automotive component manufacturers in South Africa, manufacturing a wide range of components, and the incentives provided by the government to increase the local content of vehicle manufactured in South Africa, the majority of vehicle manufacturers source most of their components from foreign ACMs located outside South Africa.

Due to the weakened rand, the price of motor vehicles has increased significantly over the last decade, and as a result, the average age of motor vehicles on South African roads has increased. However, this creates an opportunity to supply replacement components, like brake pads, starter motors, and air filters to the after-market. But, a visit to any retailer of motor vehicle spare parts, like Midas, reveals that the majority of the components are imported. And, this raises the question as to why after-market wholesalers and retailers do not source most of their stocks from local ACMs.

While previous studies have examined supply chain considerations of motor vehicle manufacturers in South Africa, and factors impacting on the competitiveness of the automotive sector, little research has been undertaken to establish the nature and extent to which ACMs in South Africa use innovative strategies to remain competitive.

1.3 Research Problem

A strong and competitive automotive industry plays a very important role in reducing the high levels of unemployment in the country, promoting economic growth, and as a generator of foreign exchange. Despite the weakness of the rand, and the generous incentives offered by the government to vehicle manufacturers in South Africa to use locally made components, many local vehicle manufacturers, like Toyota and Mercedes Benz, and after-market wholesalers and retailers, like Midas, source most of their automotive components from ACMs outside South Africa. This is due to the fact that the local automotive components manufacturers (ACMs) are not internationally competitive (Naude 2013).

While South African ACMs face some unique challenges, like the relatively high levels of HIV/Aids among the workforce; a poor education system, and the militancy of the trade unions, compared to ACMs located in other parts of the world, they still need to be innovative to produce and deliver high quality components at competitive prices, if they want to supply the local motor vehicle manufacturers and the after-market. According to Barnes and Kaplinsky (1998), innovation is not only a necessity for survival, but is also a source of competitive advantage, and in this regard, this study wishes to establish the nature and extent to which ACMs in Gauteng use innovative strategies to enhance their competitiveness.

1.4 Aim and objectives of the study

The aim of this study was to examine the nature and extent to which automotive component manufacturers in Gauteng used innovative strategies to enhance their competitiveness.

The objectives of the study were:

- to establish the nature and extent to which an innovative culture existed amongst automotive component manufacturers in Gauteng;

- to examine the nature and extent to which automotive component manufacturers in Gauteng used innovative strategies in their manufacturing processes;

- to investigate the impact of innovative strategies on new product development among ACMs in Gauteng; and

- to recommend innovative strategies which ACMs in Gauteng may use to improve their competitiveness.

1.5 Significance of the study

The automotive industry plays such an important role in the South African economy that many people view the state of the automotive industry as a good indicator of the state of the South African economy. Therefore, it is important that this sector grows, and that local motor vehicle manufacturers and after-market wholesalers and retailers source a greater portion of their components from local ACMs. A few studies related to innovation in South Africa have been undertaken, but there is little evidence that a study examining the use of innovative strategies among ACMs in South Africa has been undertaken. Hopefully, the findings from this study will be used by ACMs not only in Gauteng, but the rest of the country, to entrench a culture of innovation in their organisations, more especially with regard to products, processes, and organizational culture.

1.6 Scope of the study

The study was confined to South African owned automotive component manufacturers that were located in the Gauteng Province of South Africa. While there are several aspects to innovation, this study was restricted to innovation linked to new manufacturing processes; new products, and organizational culture.

1.7 Research methodology and design

A literature study using secondary sources of information was conducted with the objective of establishing, assembling and integrating theory with regard to the use of innovative strategies in the automotive industry. Academic journals, industry publications, textbooks, as well as governmental organisations' reports and publications were referenced. Primary data was collected via a structured closed-ended questionnaire that was e-mailed to all the ACMs based in the province of Gauteng, South Africa.

The data from the completed questionnaires was captured on an Excel spreadsheet, and descriptive statistics was used to analyse the preliminary data, and inferential statistics was used to present the data in a statistical format so that important patterns, relationships and analysis became more meaningful. The Statistical Program for Social Sciences (SPSS), version 23.0, for Windows, was used to analyse the data and to conduct the relevant statistical tests, and the results were presented in the form of tables and charts.

1.8 Structure of dissertation

Chapter 1: Overview of the study

Chapter one provides a brief background to the study; identifies the research problem, and states the aim and objectives of the study. The significance and scope of the study is outlined. Thereafter, the research methodology and design employed for this study is presented, and the structure of the dissertation is briefly outlined.

Chapter 2: Literature review

In this chapter a review of the relevant literature regarding the automotive industry, more specifically the automotive component industry, and innovation, is undertaken.

Chapter 3: Research methodology and design

This chapter focuses on the research methodology used in this study. It includes a discussion of the research design, the research instrument, data collection methods, data analysis techniques, and the methods used to ensure that the research is valid and reliable.

Chapter 4: Presentation, analysis and discussion of results

The results of the study are presented, either graphically, via bar graphs and pie charts, or via tables; analysed, and related to the relevant literature reviewed in Chapter Two, and/or to the results of similar studies conducted among ACMs.

Chapter 5: Review, Conclusion and Recommendations

The major part of this chapter contains a summary of the main findings from the literature reviewed and the empirical study, and recommendations for improving the innovativeness of ACMs in Gauteng, and for future research.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The first part of this chapter focuses on the relevant literature pertaining to innovation, including, *inter alia*, the factors influencing the innovation process*;* the product innovation process, and the link between innovation and competitive advantage. The second part of this chapter examines the literature pertaining to the automotive sector, more especially, automotive component manufacturers (ACMs) in South Africa; the promotion of this sector by the state through the Motor Industry Development Plan (MIDP), and thereafter, the Automotive Production and Development Programme (APDP), and the challenges faced by ACMs in South Africa.

2.2. Definition of innovation

Innovation is derived from the Latin verb *innovare or innovus*, which literally means "into new." In its simplest form, innovation refers to doing something different. Innovation in business is linked to three different concepts – innovation, improvement, and invention. Improvement is doing something better, while invention is the act of creating an idea or a method (Costello and Prohaska 2013). Therefore, innovation focuses on the creativity of individuals in the organisational context. Creativity can therefore be defined as the generation of new or novel ideas, concepts and associations that are useful for products, services, processes and procedures by individuals or groups in a specific organisational context (Cropley 2008). Vermaak, Jasper and Steyn (2013) contend that innovation, broadly defined, encompasses new products or services, new technologies, new organizational structures or administration systems, or new plans or programmes pertaining to organizational members. Kotsemir and Abroskin (2013) maintain that, in the last decade, the concept of innovation shifted from a strong scientific definition to a vague and strange concept. They also note that there is no unifying and commonly accepted understanding of the innovation concept.

Kotsemir and Meissner (2013) state that the innovation typology also shifted from a more or less well-structured system to a system with a large number of very different elements. Along with the already well established types of innovation, such as product or process innovation, there are completely new types of innovation (such as frugal innovation and/or organic innovation). These new types of innovations require appropriate models for the description and explanation of their development.

According to Elms and Low (2013), innovation consists of the following key dimensions:

- *pragmatic*: focus on converting “ideas into cash” (revenue growth and profits);
- *customer-centric*: through discovering and serving customer needs, both explicit and hidden, to create a differentiated customer experience;
- *open*: in order to cast a wide net to capture the best ideas from internal and external sources, as well as the capability to capitalize on them;
- *holistic*: innovation is not just about technology or a new product, but also the brand; operating environment; employees; the impact on the business ecosystem, and the impact on society, and
- *controlled experimentation*: the focus is on creating a culture that encourages organizations to experiment, rapidly prototype new ideas, and learn and capture new knowledge.

2.3 The Product Innovation Process

The development of a new product refers to a specific sequence of actions whereby a company decides to develop an original idea or concept in order to achieve a desired product that can be produced and marketed according to marketing requirements (Kalra and Pant 2013). During this process, a whole range of non-manufacturing aspects are defined, such as the supply of components; the method of distributing the

product; the way in which it must be dismantled for transportation purposes, and packaging (Soberman and Soman 2013). According to Ackermann (2013), the product innovation process is critical, as 70-80% of all costs and most of the features of the new product are determined at the beginning of the developmental process.

During the product development stage a decision is also made as to which R&D projects the company should initiate, and of these, which should be subcontracted, and which should be developed internally. According to Georgy & Mumenthaler (2012), innovations, especially product innovations, are sometimes highly complex, which may lead to possible reluctance from potential customers to purchase the new product, which in turn, hampers the diffusion of innovation. Saksena (2007) argues that a ground-breaking innovation gives a company a significant competitive advantage over its competitors, and that some of these are closely linked to technological developments.

The more a company's innovation process is well structured, the greater the capacity for innovation will be. According to Wyman (2007), companies must not only learn how to manage the innovation process, but must also know how to change their own sets of values, however successful these might have been in the past. Managing innovation is part of a strategic thinking process - a medium and long-term analysis of the elements that have repercussions on business, market trends, technological advances and competitors' strategies (Mondragon and Mondragon 2013).

Innovation management extends to the processes related to marketing, thus offering a product or service in a completely different way, which may result in creating a differentiating factor for many manufacturing companies (Nieman, Hough & Niuewenhuizen 2008). According to Tidd and Bissant (2009), the involvement of marketing from the beginning of the design process has, in many instances, given rise to "extended products". This term refers to products that are designed in an integrated manner, which takes into consideration packaging, point of sale and communication strategy (Joshi, Nepal, Rathore & Sharma 2013).

2.3.1 Creation of new concepts as part of the innovation process

The innovation process involves identifying new concepts of products and services and anticipating customers' needs by analysing market trends and competitors' successes (Wyman 2007). It also involves encouraging new ideas and creativity amongst staff; identifying the mechanisms and criteria used for selecting the ideas to be developed and planning the creation of new product concepts (Isckia & Lescop 2010). Ekvall (1996) refers to this resource as "Idea Time", and further states that in a climate where every minute is booked and specified, the time pressure makes thinking outside the instructions and planned routines impossible. Martin and Terblanche (2003) and Stamm (2008) are of the opinion that an organizational culture that promotes creativity and innovation should allow employees time to think creatively and experiment.

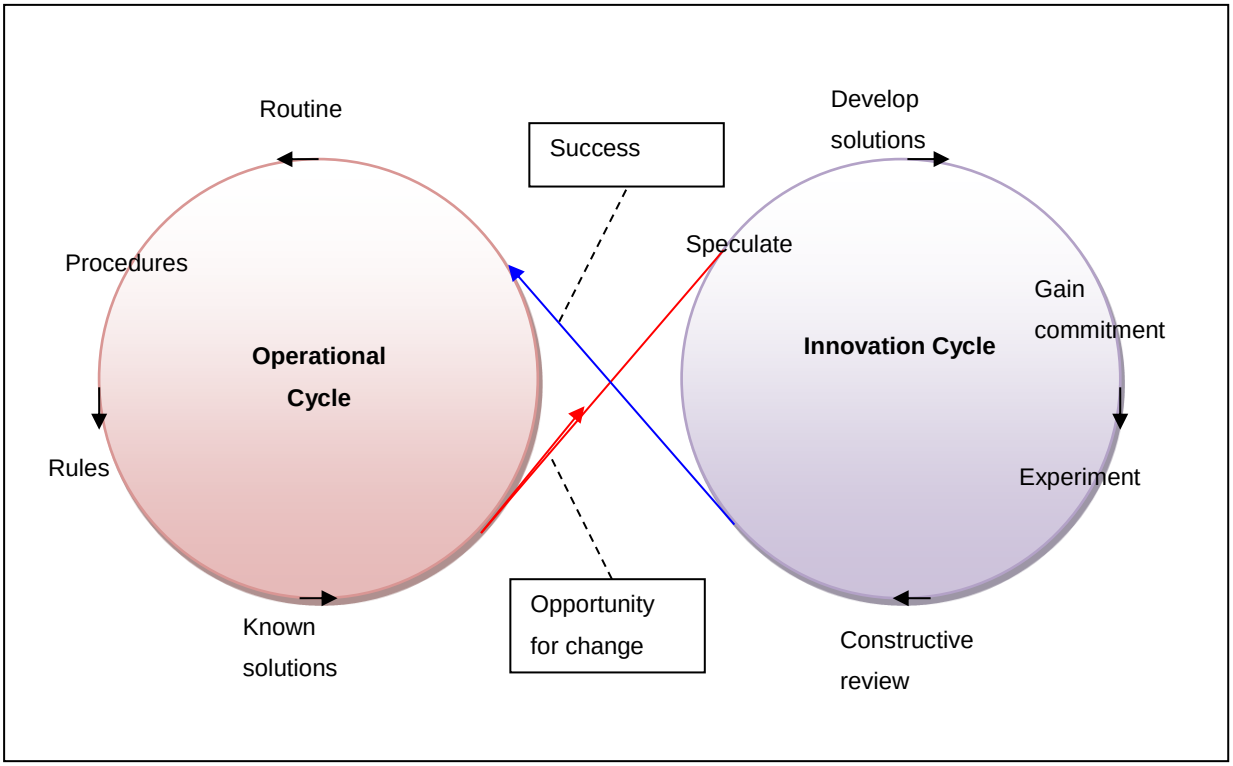
Kristensen (2004) postulates that workplace physical context (space) can facilitate the various phases of the creative process. An example would be space that maximizes access to the information that enhances individuals' and teams' innovative potential, especially in relation to preparation and incubation stages. Likewise, office space designed around circular structures and radial shapes, with clusters and grids, are likely to promote different aspects of the innovation process. Beunza and Stark (2004) propose that knowledge must be shared beyond the office space, via multiple communication channels, in order to enhance innovation potential.

According to Kaufmann and Sternberg (2006), one of the difficulties of innovation identified in the literature is whether creativity can be increased through training. The authors further state that there is a general consensus among scholars that the most common feature in various creativity training programmes is the aspect of promoting divergent thinking. Samson (2010) contends that for an innovative firm to thrive, it must be devoted to staff training, for example on problem solving; creativity, and teamwork.

Stamm (2008) presents a graphical relationship between the operational and innovation cycles (Figure 2.1). New concepts developed through the innovation cycle are co-opted into the operational cycles, thus becoming routine chores which are effectively maintained by the quality management systems. Since the innovation

process involves implementation, the operational cycle is relevant for profitably implementing new ideas to gain a competitive advantage.

Figure 2.1: The interaction between the operational and innovation cycles



Source: (Stamm 2008:11)

Innovation involves implementing change, since change management capability and readiness for regular change are prerequisites. According to Samson (2010), in innovative firms employees anticipate change, expect change, and drive change. It is more than a mindset, and it promotes opportunities for more attitudinal behavioral changes. Change is welcomed and embraced, rather than feared and resisted.

2.3.2 Factors influencing the innovation process (and creativity)

Various factors influence the nature and extent to which organisations innovate, and two of the most important factors have been identified as organisational culture and climate, as well as the organistion's strategic intent, and these shall be examined below.

2.3.2.1 Organisational culture and climate

Organisational culture refers to commonly held beliefs, attitudes and values that exist in an organization. Kaufmann and Sternberg (2006) state that, put simply, culture is "the way we do things around here". Colquitt, Lepine, and Wesson (2009) contend that culture is the shared social knowledge within an organization regarding the rules, norms and values that form the attitude and behaviours of its employees. According to Samson (2010), in an innovative organisation, innovation is part of the strategic vision and mission of the organisation; hence, innovation is incorporated into the company values. As a result, it becomes part of every employee's mindset.

An organisation's climate, however, refers to the recurring patterns of behaviour exhibited in the day-to-day environment of the organisation, as experienced, understood, and interpreted by the individuals within that organisation (Isaksen, Ekvall, Lauer, & Britz, 2000). Researchers tend to agree that an individual's ability to innovate at work is influenced by several factors, which can be classified into three levels of analysis, namely: the individual, group and organisational level (Patterson, Kerrin & Gatto-Roissard 2008).

McLean (2005) contends that the organisational culture and climate influence variables such as motivation, creativity skills, and expertise. These variables, in turn, influence creativity in the organisation, and, therefore, impact on an individual'' behaviour. The author further notes that creativity is a phenomenon that is initiated and exhibited at the individual level and that the challenge is with inter-relationships, interactions and dynamics amongst groups within an organisation.

According to Kruger and Johnson (2012), innovation is most likely to occur in organizations that:

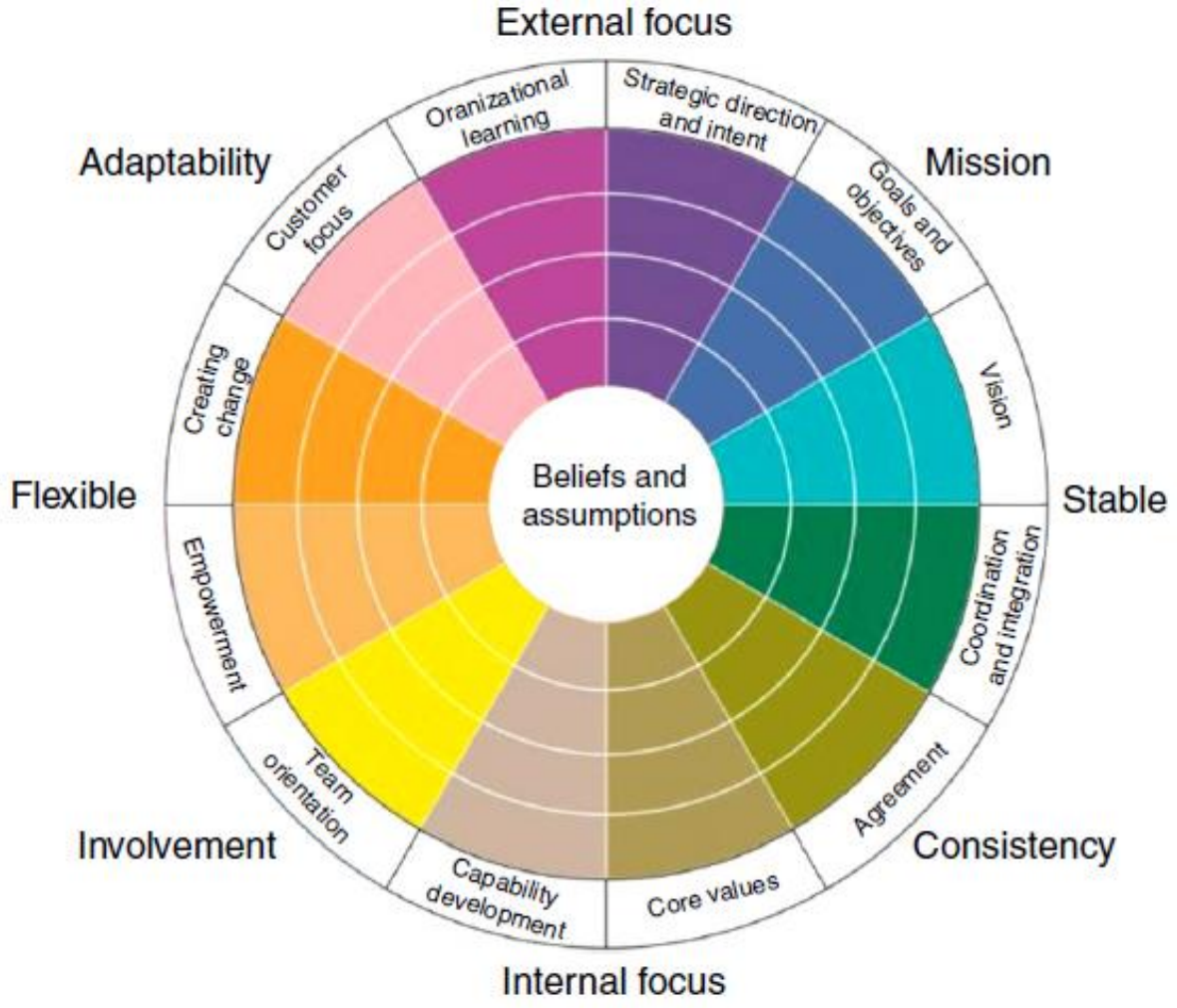
- have integrative structures;
- emphasize diversity;
- have multiple structural linkages inside and outside the organization;
- have intersecting territories;
- have collective pride and faith in people's talents, and

- emphasize collaboration and teamwork.

According to Finestone and Snyman (2005), South Africa is unique because of its social, political and economic history. As in other culturally diverse countries, South African organisations aim to create a unified organisational culture in which European, African and Asian countries are fused. South Africa is differentiated by different cultural dynamics that need to be integrated for businesses to be able to compete in the global economy (Johnson 2012). According to Alfaro, Bizuneh, Moore, Ueno, and Wang (2012), Automotive Component Manufacturers (ACMs) in South Africa experienced a breakdown in cultural cohesiveness due to the apartheid system, which emphasized segregation. Some ACMs have made noticeable progress in terms of unifying cultural differences through focusing on innovation and by appreciating contributions from diverse backgrounds.

The actions and behaviour of staff in an organisation reflect the organisational culture, which is the shared social knowledge regarding the rules, norms and values that shape the attitude and behaviour of staff within an organisation (Colquitt *et al*. 2009). The organisation attempts to select recruits who are likely to share their values. These values, which are important for innovation, are illustrated in Figure 2.2 below.

Figure 2.2: The Denson model



Source: Sharifirad and Ataei (2012:499)

2.3.2.2 Organisation strategy

The survival of organisations in a globalized, dynamic market is dependent on how innovation is incorporated into their business strategy (Ciravenga 2012). According to Ambe (2012), strategy guides organizations to operate in ways that outperform competitors. To encourage innovation, an organisational strategy should encourage a sharing of values which creates a sense of identity and a clear set of expectations; the ability to reach agreement on critical issues, and reconciliation when differences occur (Yilmaz and Ergun 2008).

An organisation must ensure that all its functions maintain consistent strategies that support the competitive strategy (Taylor 2004; Hines 2006). Innovation indicators

should thus be viewed as essential tools for decision-making, which can influence or define competitive strategies and policy-making (Lugones 2009). Joshi *et al.* (2013) posit that in order to gain a competitive advantage the customer relationship with the organization needs to be prioritised.

Hull (2005),Hines (2006), Jonsson (2008) and Chopra and Meindl (2010) argue that as organisations establish modern manufacturing methods, strategic; organizational, and marketing strategies have to be adapted as well in order for the firm to be fully efficient. Automotive companies often need to make substantial changes throughout the organization in order to adapt to significant changes in the market. Thus, the problem of internal consistency becomes critical. According to Sharifirad and Ataei (2012), the staggering speed of change and lack of agility cause organizations which are experiencing efficiency and consistency not to catch up with those which are more flexible.

2.3.3 Measures of Innovation

The importance and use of measuring innovation processes is directly related to the links between innovation and competitiveness. According to Lugones (2009), innovation indicators should be viewed as essential tools for decision-making, which can influence defining competitive strategies and policy-making. Some experts, like Muller, Välikangas and Merlyn (2005) contend that innovation should be measured through three different lenses: the resource view (resources dedicated to innovation-related activities); the capability view (inputs through the number of innovation tools), and the leadership view (inputs through percentage of executive time invested in innovation versus operations, or percentage of management team trained in the use of innovation tools).

In addition, Jamrog, Vickers & Bear (2006) identify eight major measures of creativity and innovation, namely:

- customer satisfaction;
- market share;
- new products/services/processes produced;
- financial impact of ideas submitted by employees;

- innovations as percent of revenues and profits;
- spending on research and development;
- spinoffs/new operations based on new products, and
- intellectual property (for example, number of patents).

Janz (2009) presented an overview of the international manuals used to measure innovation, as shown in Table 2.1 below.

Table 2.1. Manuals on measuring innovation

MANUAL	OVERVIEW	MAIN INDICATORS
OECD Manuals		
Fractal manual	How to measure R&D?	R&D personnel, and Intramural R&D expenditure.
Oslo manual	How to measure innovation?	Intramural and extramural R&D; Acquisition of machinery; Innovation expenditure; Impact of innovation; Objectives of and Obstacles to innovations, and Linkages in innovation (information sources and co-operation).
Canberra manual	How to use human resource data to measure innovation?	Person (individual) in household surveys; population censuses, and administrative records.
Patent Statistics manual	How to use patent data to measure innovation?	Number of patents, citation based indicators (weighted patent counts), and patent values.
Non OECD Manuals		
Bogota manual	How to measure innovation in Latin American countries?	Innovation focus; Innovation efforts; Innovation results and goals; Innovation funding, Innovation linkages, and Innovation policy assessment.
NEPAD study	How to measure innovation in African countries?	Innovation-related policies: importance impact, and learning process

Source: Janz (2009: 21)

Jamrog, Vickers & Bear (2006) accept that companies have many options when it comes to measuring innovation. However, the authors contend that their choices should be influenced by the industry to which their organisations belong; their

experience in using such measures, and their ability to make each measure as accurate as possible.

2.3.4 Evolution of innovation process understanding

The evolving understanding of innovation as a process of activities raises new challenges to innovators (Kotsemir and Meissner 2013). According to Godin (2008a), these challenges are expressed in the increasing complexity of innovations which are, in turn, determined by the complexity of the surrounding framework conditions. Consequently, the complexity, as expressed by the number of information sources, knowledge and application fields for innovation is rising. In light of this observation, innovators need to analyse and process more information for the same purpose.

Kotsemir and Meissner (2013) note that there is a broad range of innovation process models. Baregheh, Rowley and Sambrook (2009) contend that all process models share the common understanding that innovation activities can more or less correctly be described and visualized in-process models. They further argue that other studies emphasize the characteristics of innovation which are defined according to innovation development stages, for example, Maidique and Wheelwright (2001) distinguish between the recognition of invention; development; realization, and distribution, as phases of the innovation process. Kotsemir and Abroskin (2013) maintain that following the development of innovation concepts, models of innovation and innovation processes evolved. According to Godin (2006), the linear process of innovation, which is discussed below, in general, distinguishes between the discovery (invention); the definition of areas of application of the results of innovation; its design; development, and use, as phases of the innovation process.

2.3.4.1 The linear process of innovation

The linear process, also called ‘technology push’/‘market pull’, was conceived in the 1960s and 1970s, and perceives innovation as a step-by-step process of sequential activities (Marinova and Phillimore 2003). According to Osterwalder and Pigneur (2009), linear processes consist of the following six elements:

- Customer insights: a simple linear sequential process, with the emphasis on research and development (R&D) and science. A technological tool designed to push products or services to the customer, based on customer demands.

- Ideation: a simple linear sequential process, with the emphasis on marketing, and the market is viewed as the source of new ideas for R&D. The brainstorming and feasibility of the product on the market pull strategy.

- Visual Thinking: recognizing interaction between different elements and feedback loops between them, with the emphasis on integrating R&D and marketing. Ideas are taken and plotted on a visual chart.

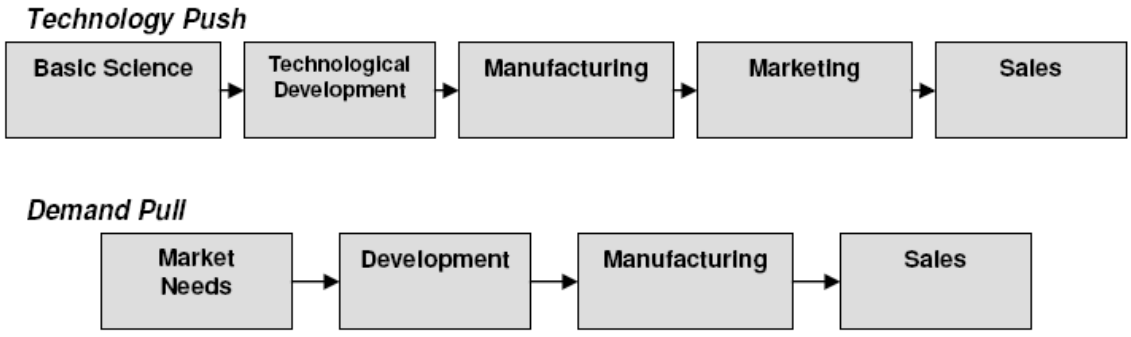
- Prototyping: combinations of ideation and visual thinking models; integration within firm, with the emphasis on external linkages. Creating samples before the actual production takes place.

- Storytelling: emphasis on knowledge accumulation and external linkages; systems integration, and extensive networking.

- Scenarios: internal and external ideas as well as internal and external paths to market can be combined to advance the development of new technologies.

The linear processes outlined above views innovation as either being pushed by technology and science or pulled by market needs, and this is shown in Figure 2.3.

Figure 2.3. Technology Push and Demand Pull Innovation processes

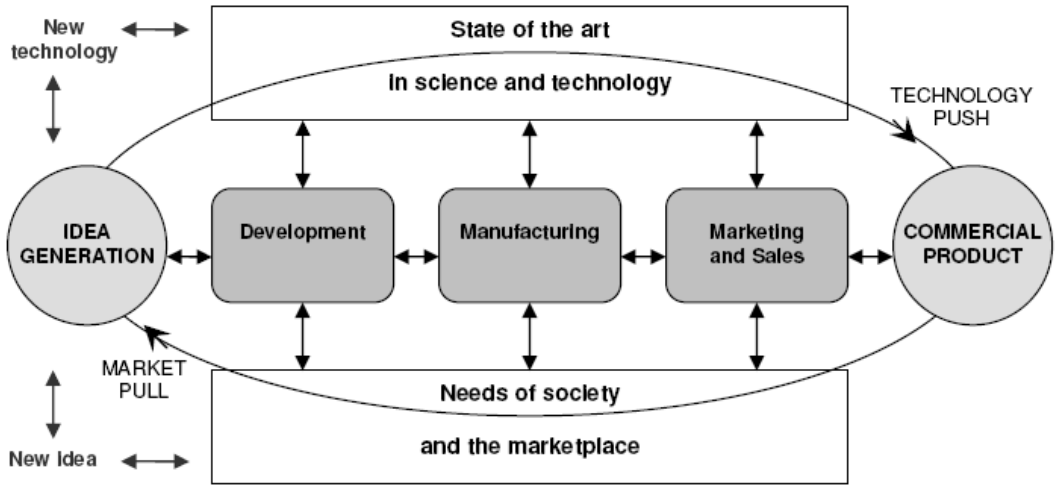


Source: Du Preez and Louw (2009:199)

However, Kline and Rosenberg (1986), criticise the linear process pertaining to "technology-push", and argue that innovations are not always triggered by science, and that firms innovate because they believe there is a commercial need for it. Gunnarsson & Wallin (2008) argue that organisations first try combinations of existing resources and only resort to research science if it fails, and add that that in many cases it is the experience of users, not necessarily science, which is an important source of innovation. They view science, which is sometimes reflected in the form of Research and Development (R & D), as a sub-process of innovation, rather than an initiating factor. The authors further question the sequential nature of innovation, as implied by the linear model, and argue that the linear process also ignores the various feedback loops at every 'stage' of the process, which can lead to totally new innovations.

The coupling *process*, as illustrated in Figure 2.4 below, recognises the influence of technological capabilities and market needs on innovation within an organisation. Although the coupling approach contains feedback loops, it is basically a sequential model with limited functional integration.

Figure. 2.4. The coupling process

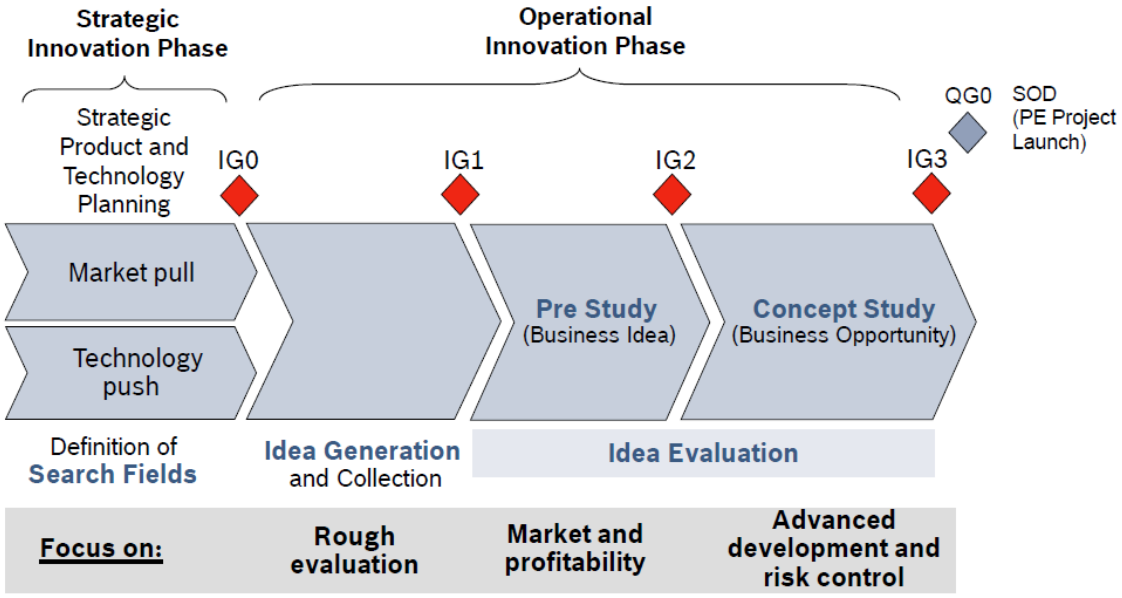


Source: Du Preez and Louw (2009:202)

One of the most well-known linear processes of innovation is the *Stage-Gate model* (Wolfgang 2013). This model divides the product innovation processes into stages, with defined gates acting as decision points between the stages (refer to Figure 2.5 below). At the end of each stage is a stage gate, which consists of a review to evaluate

whether the previous phase was successfully completed. If the phase is reviewed positively, work proceeds to the next phase; if not, then work continues or remains within that phase until it can successfully pass the gate.

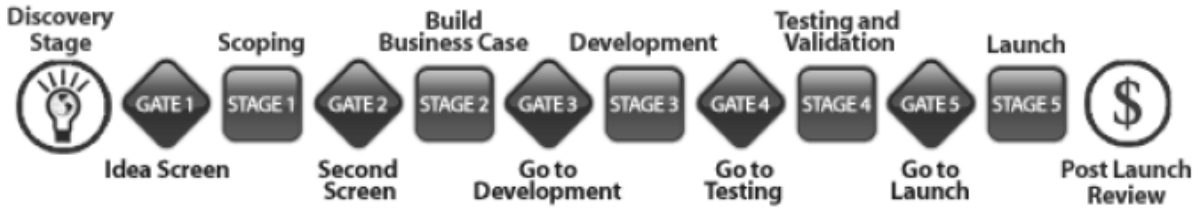
Figure 2.5. Stage-Gate model Idealisation Process



Source: Wolfgang (2013:86)

The above diagram details a screening process that generates a lot of ideas and the selection of "good ideas" to Idea Generation 1(IG1) and the "best ideas" to Pre-Study (IG2). At the pre-study stage, an evaluation is performed to ascertain whether there will be a market for the new product, and whether it will be large enough to be profitable. If the evaluation shows that the market for the new product will not be large to make it profitable, the product is not developed. However, if it is profitable, then the next stage is entered. Another version of the Stage-Gate model is presented below.

Figure 2.6. Stage-Gate model



Source: Du Preez and Louw (2009:203)

According to Du Preez and Louw (2009), the Stage-Gate model above has the following advantages:

- better quality during the innovation process;
- assurance of comprehensiveness in ensuring that no critical activities are left out, and
- during the idea and concept generation, the gates are rigorous.

A disadvantage of the above model could be that the gates are too rigorous, especially in the early stages of idea and concept generation. Although a sequential approach with evaluation gates increases the effectiveness and efficiency of incremental innovation processes, according to Wolfgang (2013), for more radical innovations, a flexible, learning-based approach is more appropriate. Also, this model does not address the post launch refinement, optimization and exploitation of the new innovation (Du Preez and Louw 2009).

2.3.4.2 The interactive approach to innovation

According to Marinova and Phillimore (2003), innovation is no longer the end product of a final stage of activity but can occur at various places throughout the process. Innovation can also be circular (iterative) rather than sequential. The authors maintain that a variety of interactions is necessary for the success of innovation.

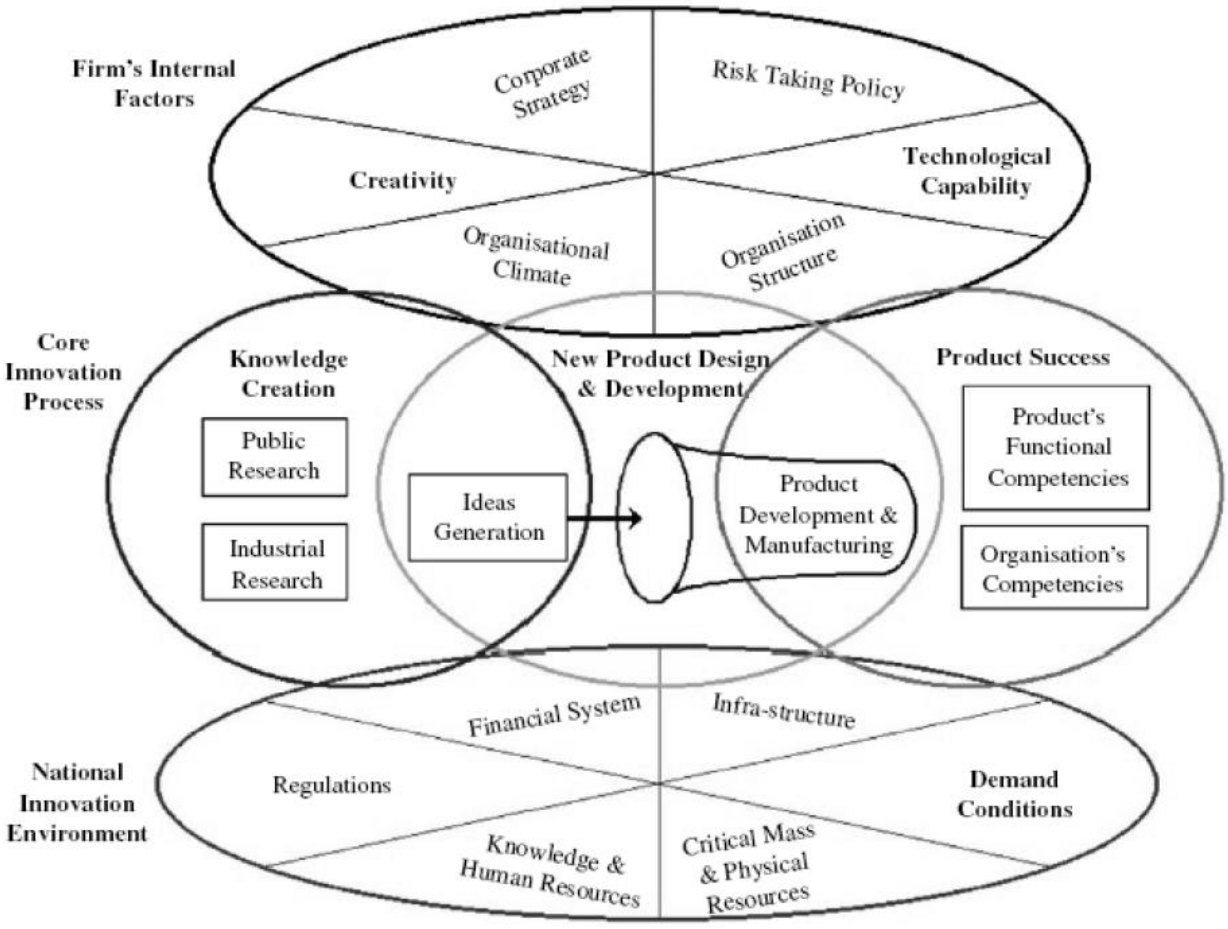
A comprehensive model of an integrated and networked innovation process was developed by (Galanakis 2006). He proposed an innovation process using a systems thinking approach, which he termed “the creative factory concept” (refer to Figure 2.7 below). According to the author, the overall innovation process comprises of the following phases:

- the knowledge creation process (from public or industrial research);
- the new product design and development process, (which transforms the knowledge into a new product, and

- the product's success in the market, (which depends on the product's functional competencies and the organisational competencies to produce a quality product at a reasonable price, and place it adequately in the market).

This above-mentioned phases are influenced by both internal factors (e.g. corporate strategy; organisational climate, organisational structure, etc.), as well as by external factors (e.g. regulations; infrastructure; financial systems, etc.).

Figure 2.7: The Interactive Innovation Model



Source: (Galanakis 2006:78)

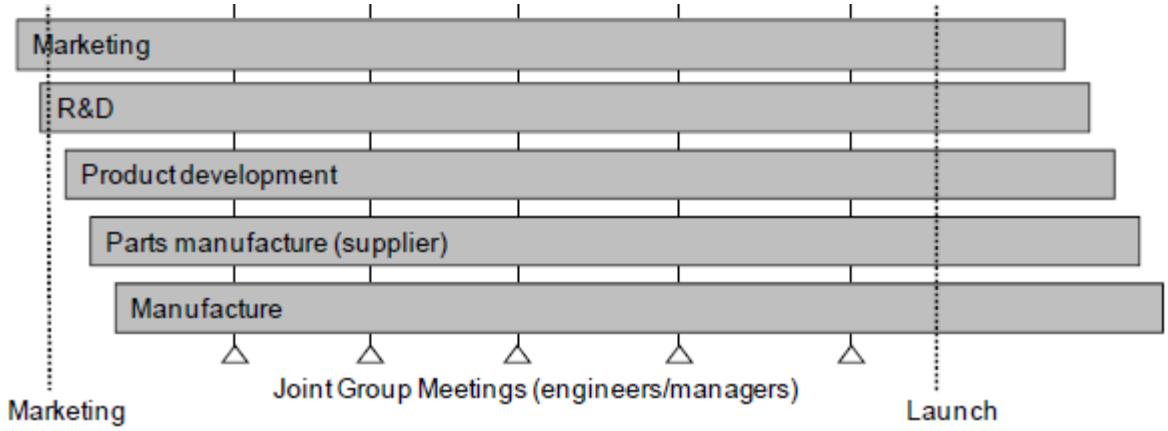
Natario, Braga, Cuoto and Tiago (2012) state that the systems approach views innovation as being characterised by complicated feedback mechanisms and interactive relations involving science, technology, learning, production, policy and

demand. The authors contend that firms never innovate in isolation but through interaction with other organisations to gain, develop and exchange various kinds of knowledge, information and other resources. These organisations might be other firms (suppliers, customers and competitors); universities; research institutes; investment banks; schools; government ministries, etc. For example, the pressure to produce more effective and efficient product development processes has led to an increase in

- horizontal strategic alliances and collaborative R&D consortia;
- strategic vertical relationships, especially at the supplier interface, and
- innovative SMEs forging external relationships with both large and small firms.

The interactive approach to innovation also views the innovation process as a series of parallel activities across organisational functions (refer to Figure 2.8 below). Greater emphasis is placed on the development of cross-functional and parallel integration within firms to gain greater potential from higher real-time information processing (Wolfgang 2013).

Figure 2.8. Fourth Generational Interactive Innovation Model



Source: Du Preez and Louw (2009:209)

2.4 Innovation and competitive advantage

According to Kalra and Pant (2013), several studies have proved that there is a positive relationship between innovation and competitive advantage. The successful implementation of new products, processes and ways of organising the business guarantee a company increased return, and hence, competitive advantage (Soberman & Soman 2013). The underlying principle, however, is that if a new idea to a firm (disregarding the sources of ideas) is successfully implemented, it drives competitive advantage (Muller 2009). Muller contends that it is of no value for a firm to boast about inventing something and yet fail to benefit financially from the invention. From the discussion above, one can conclude that creativity alone, without innovation, is not effective.

Tidd and Bessant (2009) state that the pattern of competitive advantage is increasingly coming to favour those organisations which can mobilize knowledge and technological skills and experience to create novelty in their offerings and in the ways in which they create and deliver. Nieman *et al.* (2008) contend that growth in an organisation can be promoted “by creating an environment conducive to creativity and innovation during the maturity stage”, while Nieman *et al.* (2008) assert that innovation “is a way of life for growing firms”. According to Hill (2009), the forces of globalisation have merged world markets, resulting in fierce competition for survival; hence, the need for organisations to innovate in order to survive.

2.5 A brief review of innovation in South Africa

According to Barnes and Black (2003), the innovation system that existed was informed by the needs of a privileged minority with a distinct supremacist agenda. Barnes and Morris (2008); Humphrey and Memedovic (2003) and Lamprecht (2009) contend that while this minority stood in the way of an integrated innovation framework, it did not prevent the country from developing some world-class innovations. They maintain that in the face of economic sanctions, innovation in selected areas, such as aerospace engineering, where advanced technologies proved difficult to source on the open market, thrived.

Kahn and Reddy (2001) argued that since the late 1940s, what economic sanctions did was to keep import substitution alive beyond any sensible economic motivation. They further stated that the military sector, agriculture industry and universities did not collaborate much, but that science was generously funded by the state. According to Serrat (2009), the idea behind this funding by the state was to encourage co-operation between government, industry and research institutions, and to place a stronger focus on applications-based research. The author adds that attempts to use the best practices from national innovation systems in other parts of the world for a new science and technology policy led to the tabling of the first White Paper on Science and Technology in 1996. The White Paper led to a number of policy initiatives, like the establishment of the Innovation Fund, which promotes initiatives aimed at increasing competitiveness and at encouraging collaboration between public Science, Engineering and Technology Institutions (SETIs), the private sector, tertiary education and civil society (OECD 2011). However, according to the OECD 2011), the situation is hampered by unemployment levels of over 40%, low skill levels; and insufficient labour mobility. Critics charge that South African science and technology policy focuses too much on technology generation by the SETIs, and too little on technology diffusion (Nag, Banerjee & Chatterjee 2007). In its quest to promote innovation, the South African government also introduced a national Advanced Manufacturing Technology Strategy (AMTS), whose objectives include the reduction of the country's dependence on imported technologies and the strengthening of local innovation (CSIR 2003).

According to Schermerhorn, Hunt, Osborn & Uhl-Bien (2011), the South African Government is increasingly involved in promoting innovation, since not only do new products and services provide employment opportunities, but economic growth development depends on the continued launching of new products. The government support for various innovation initiatives are also aimed at increasing the global competitiveness of manufacturers and suppliers, in order to ensure the manufacturing industry's continued viability (NAACAM 2013).

Some South African companies regularly send staff abroad to learn best practices or receive on-site input from their foreign partners (Naude 2013). According to

Bronkhorst, Steyn and Stigling (2013), the purpose of these missions can be both learning and upgrading innovation. Some firms monitor industry dynamics on an on-going basis, in order to build competences before market demand for new or modified products actually occurs. Buchmann and Pyka (2013) note that R&D promotes learning in that it contributes to making informed choices about which external knowledge to select; how to evaluate and assimilate it, and in what ways to exploit it. Hence, R&D is not only about generating new information (Bronkhorst *et.* al 2013).

According to Buchmann and Pyka (2013), innovations are identified as the key to success in South African organizations because they allow firms to escape destructive price competition. There is a long way from improving production capacity to developing technological capability and to engaging in innovation (CSIR 2003). According to Lorentzen (2005), the mechanisms of the post-apartheid national innovation system are not well understood, and this tends to jeopardise innovation activities in South Africa, both directly and indirectly.

2.6 THE SOUTH AFRICAN AUTOMOTIVE INDUSTRY

2.6.1 The economic importance of the South African automotive industry

The automotive industry comprises the largest manufacturing sector in the world, with an output equivalent to that of the world's sixth largest economy (Nag, Banerjee and Chatterjee 2007; OICA 2008). While the industry is a key sector in many advanced industrialized nations, it is also of increasing significance in the emerging economies of North and East Asia, South America and Eastern Europe, as well as South Africa (Nag, Banerjee and Chatterjee 2007). Although South Africa produces less than 1% of the world's motor vehicles, the local automotive sector, which includes automotive component manufacturers, is regarded as large. According to Whitfield (2016), the president of the National Association of Automobile Manufacturers of South Africa (NAAMSA), in 2015 approximately 115 000 highly skilled employees were involved in vehicle and component production; the automotive industry contributed about 7.5% to the country's gross domestic product (GDP); accounted for approximately 33.5% of the country's manufacturing output, and for 14.6% of total exports. The automotive industry is the third largest sector in the South African economy and it plays such an

important role in the economy, that it is often viewed used as a barometer of the health of the economy.

South Africa has developed a major automotive motor industry with local vehicle manufacturing plants for Volkswagen, BMW, Nissan, General Motors, Ford, Mercedes-Benz and Toyota (Van der Merwe & Visser 2008). This has resulted in an increase in the number of locally based automotive component manufacturers (ACMs), thereby increasing competition among them. The government has identified the automotive industry as a key growth sector, with the aim of increasing vehicle production to 1.2 million units by 2020, while significantly increasing local content at the same time. According to the National Association of Automobile Manufacturers of South Africa (NAAMSA) (2014a), South Africa accounted for 76% of the African continent's vehicle production in 2012. In 2015, South African vehicle manufacturers exported 333 802 motor vehicles to over 100 countries (Whitfield 2016). On a continental basis, Europe and Africa represented the major destinations with 28.9% of total motor vehicles manufactured, exported into the Euro zone and 28.5% of total exports, destined for African countries. A wide range of South African manufactured automotive components are also exported to the majority of countries in Africa for the after-market and as replacement parts. Total automotive exports (vehicles and automotive components) to Africa increased by a significant 53.6%, (R6.2 billion) to R17.8 billion from 2011 to 2012 (NAAMSA 2014a).

According to the 2011 Automotive Industry Export Council (AIEC) Annual Report (2011: 75), automotive component manufacturers play a crucial role in job creation, employing approximately 65 000 people in 2010, and they make a significant contribution to the economy of the country. The automotive sector also helps in people development, with workers obtaining valuable experience in areas such as design, manufacturing, supply chain, marketing and sales, and research and development. It also generates significant foreign exchange earnings through exports, which are crucial to the country's current account and trade balance with other trading partners. The automotive industry is also the largest attractor of foreign direct investment in manufacturing plants and machinery, which have raised the productivity and the quality of motor vehicles and components to international standards (Info Doc A/2013). The automotive industry also contributes to the government revenue in the forms of

personal income taxes; company taxes; levies, such as the carbon dioxide environmental emission levy; import duties, and value-added taxes. Table 2.2 below summarizes the contribution made by the automobile industry in South Africa.

Table 2.2: The South African automobile industry's contribution to the economy

Generate government revenue	Create economic development	Help people development
• Vehicle sales • Levies - environmental emission fuel levy • Ad valorem duties • Customs and excise duties - import duties • Business taxes • Personal income taxes • Value added taxes • Earn foreign exchange through exports	• Contribution to gross domestic product • Inflow of foreign direct investments in related industries	• Job creation and skill development • The automotive sector is responsible for the training and development of valuable technical and managerial expertise.

Source: NAAMSA (2013)

The South African automotive industry has established international credibility to supply quality products, on time and at competitive prices. It is at the forefront of cutting edge manufacturing technology, such as the lean principles of the Toyota Production Systems, which is also employed in other industries to improve their efficiency and profitability (NAAMSA 2013).

2.6.2 Range of products manufactured by ACMs in South Africa

According to Comrie, Terreblanche Johnson and Syman (2013) number of automotive component manufacturers are located in close proximity to locally-based OEMs, and the ACMs produce a wide range of parts, including catalytic converters and exhaust systems; trim; harnesses; electronics; just-in-time assemblies; bearings; shocks; filters; plugs; machined and plastic components; tyres; and toughened glass. According to Bedenhorst-Wiess and Naude (2012), alliances between local ACMs and locally-based OEMs are important, because as South African ACMs succeed in becoming more efficient and competitive, an increasing number of local and even some international OEMs will be inclined to purchase components from them which, in turn, will lead to further economies of scale.

2.6.3 The liberalisation of the South African automotive industry

In 1994, South Africa became a democratic country, and since 1995, planned liberalisation of the automotive industry in South Africa was introduced. This meant that the South African automotive industry operated in a completely open economy, with no trade barriers to provide artificial levels of competitive advantage. This also meant that the original equipment manufacturers (OEMs) were no longer forced to purchase from local component manufacturers (Black 2009). As a result of their rapid exposure to international competition, automotive component manufacturers in South Africa have suffered enormous economic difficulties (Barnes and Black 2003).

The liberalisation of the South African automotive industry resulted in the acquisition of technology by local firms, which was modified to suit local needs (Black 2009). At a more basic level, firms produced industrial goods using known combinations of equipment, skills, specifications and organisational systems. However, given their limited production capacity, many organisations did not see the need for upgrading their machinery and equipment. According to Tidd and Bessant (2009), to make the latter happen, firms needed to have the competencies to incorporate new technology into organisations. These competencies were also critical for continuous access to

foreign technology, with a view to moving closer to the global technology frontier (Worku & Muchie 2013).

2.6.4 The reintegration of South Africa OEMs with their global parent OEMs

The automotive industry had been directly affected by the re-incorporation of South African-based OEMs, (e.g. Mercedes-Benz and BMW), into their global families. Prior to the 1990s, the majority of domestic- based OEMs were 100% South African owned, operating under licensing agreements with motor vehicle manufacturers like Mercedes Benz and Volkswagen. This changed as a result of OEMs being either fully or partly owned by MNC parent companies (Black 2001). The reintegration of the domestic OEMs/motor vehicle manufacturers into their global families created both opportunities and threats to domestic ACMs. South African based vehicle manufacturers no longer accepted the previous performance standards of their local component suppliers. According to Black (2009), this did not only relate to pricing issues, but to a range of other performance issues, such as quality standards; compliance with internationally set specifications; delivery reliability; new product development capabilities, and flexibility. While the reintegration forced the local automotive component manufacturers to comply with internationally set performance standards, or lose business, it also created exporting opportunities (Black 2009).

The reintegration of original equipment manufacturers into the operations of their global parent companies also left them with little influence on where research and development took place. This decision is taken by the global parent companies, who are influenced by favourable incentives and policies offered by host countries (Barnes and Morris 2008).

Both the liberalisation of the South African automotive industry and the reintegration of the local OEMs/motor vehicle manufacturers into their global families negatively affected the automotive industry, and given the importance of this industry to the South African economy, the South African government introduced the Motor Industry Development programme (MIDP) in September 1995. The MIDP, which is discussed below, was introduced to assist the South African automotive industry to become

globally integrated and increase its competitiveness (Department of Trade and Industry 2003).

2.6.5 The Motor Industry Development Programme (MIDP)

The South African government identified the automotive industry as an important sector for both economic growth and the creation of sustainable employment, and in this regard, introduced the MIDP on 1st September 1995. According to NAAMSA (2007:8), the purpose of the MIDP was to assist and promote changes in the automotive industry from a highly protected, inward looking, inefficient and uncompetitive industry to an outward looking, globally competitive industry (NAAMSA 2007: 38). The intention was to gain maximum economic benefits by exporting motor vehicles and automotive components. The MIDP was also introduced to create new empowerment opportunities, and to contribute towards growing the domestic automotive industry.

Another objective of the MIDP was to gradually integrate the automotive industry into the international value chain, and to attract new foreign direct investment, skills and technology. In addition, the MIDP's objective was to retain and create new employment and to improve the balance between the industry's imports and exports (Vermeulen 2004: 64). The MIDP was also designed to assist the component manufacturers in increasing production volumes and to export components to new foreign markets and to earn export rebates in the form of import rebate credit certificates (IRCCs), which would be traded with the motor vehicle manufacturers. The motor vehicle manufacturers would use these IRCCs to offset import duties on low volume products, and thus encourage the motor vehicle manufacturers to increase their local content in the domestically manufactured motor vehicles.

The benefit to those automotive components manufacturers participating in the MIDP was the overall savings in import duties. Productive Asset Allowance (PAA) was an incentive offered to those manufacturers who had invested in new assets for the assembly of light motor vehicles and the manufacturing of automotive components. A PAA rebate credit certificate was issued to the manufacturers over a period of five

years, at a rate of 20 percent per annum. The PAA certificate was used to offset import duties for importing fully built-up motor vehicles.

According to NAAMSA (2012), compared to India and China, the MIDP did not assist the South African automotive industry in becoming a sustainable global market share contender (NAAMSA 2012). A review of the impact of the MIDP, conducted by Bronkhorst (2010), also indicated that the MIDP was not successful in achieving all of the policy objectives set by the South African government. Despite this, the South African government, through the Department of Trade and Industry (DTI), has continued to support the South African automotive industry (Department of Trade and Industry 2010a).

Another criticism of the MIDP, according to Jacobsen (2013), was that it was not World Trade Organisation (WTO) compliant, "as certain provisions violated the WTO Agreement on subsidies and countervailing measures". Under the subsidies and countervailing measures agreement, the MIDP was seen as a prohibited subsidy, in that it was an export based incentive.

The MIDP ended in 2012, and was replaced by the Automotive Production and Development Programme (APDP) in January 2013, which is discussed below.

2.6.6 The Automotive Production Development Programme (APDP)

The Automotive Production Development Programme (APDP) replaced the MIDP with effect from 1 January 2013, and will end in 2020. The purpose of the APDP is to provide assistance to both the component manufacturers and the motor vehicle manufacturers, so that they can provide cost competitive components and motor vehicles. As stated in the policy (South Africa 2013: 8-21), "The APDP is a government programme which is aimed at creating an environment that will enable the light motor vehicle manufacturers to significantly grow production volumes and component manufacturers to significantly grow value addition, leading to the creation of additional employment opportunities across the automotive value chain". The APDP's objective

is to raise the volume of cars manufactured in South Africa to 1.2 million a year by 2020, and to diversify the automotive component chain.

The APDP differs from that of the MIDP in that it is a local manufacturing incentive and not an export-based incentive (Deloitte & Touche 2009). Zimmerman, the chief executive officer of Mercedes-Benz S.A. indicated that the APDP provided the certainty needed to make big investment decisions (Hartley 2013). In this regard, the programme has been credited by Whitfield (2016), the president of NAAMSA, for the investment of more than R28 billion into capital projects by the vehicle and component manufacturers during the 2013 – 2106 period.

Under APDP, the automotive components and the motor vehicle manufacturers qualify for a production incentive (PI). The PI is calculated at the point of sales, based on the value added on qualifying components and motor vehicles. The PI effectively replaces the import rebate credit certificate (IRCC) incentive system by changing the calculation to be based on production output as opposed to export values. The incentive still remains a local-value added incentive in that the foreign currency usage costs incurred is deducted from the local invoice prices or free-on-board export sales values. The benefits under the PI are far greater for component manufacturers as there will be additional benefits accruing from components sold locally (Info Doc A/2014).

The automotive investment scheme (AIS) was designed to grow and develop the automotive sector, through investment in new and/or replacement models and components with the intention of increasing plant production volumes; sustaining employment and strengthening the automotive value chain. The AIS is a taxable cash grant of 20% of the value of qualifying investment in productive assets, as approved by the DTI, and is paid over a three-year period to the automotive components and motor vehicle manufacturers. An additional taxable cash grant of 10% of the value of qualifying investment in productive assets is granted to ‘strategic projects’ (Automotive Industry Export Council 2011: 10).

According to NAACAM (2013), the government is supporting various initiatives geared at increasing the global competitiveness of suppliers in order to ensure the industry’s continued viability as an area of growth and contribution towards the advancement of

manufacturing in South Africa. The Department of Trade and Industry (DTI), in collaboration with the AIDC (Automotive Industry Development Centre) and the United Nations Industrial Development Organisation (UNIDO), has tailor-made a set of programmes geared at improving the industry through the application of world-class manufacturing techniques (NAACAM 2013).

The automotive industry in South Africa is one of the largest contributors to the economy; hence, the government's decision to continue supporting the automotive industry. Also, in a study conducted by Lamprecht (2006), the author found that industry stakeholders were of the opinion that the South African automotive industry would not be able to compete globally in the absence of such support.

Despite the benefits of the APDP outlined above, there have been some criticisms of the programme. According to Bronkhorst *et al*. (2013), the introduction of stable tariffs until 2020 may have a negative impact on the affordability of vehicles within South Africa, and this may motivate vehicle manufacturers to reduce manufacturing costs by sourcing components from outside South Africa, which could be counter-productive in the long run. On the one hand, the APDP aims to facilitate an increase in value addition, and on the other, it continues to strive to create more affordable motor vehicles. The authors argue that if the APDP does not provide enough support to component manufacturers to manufacture technology-intensive components at competitive prices, OEMs may turn to foreign component manufacturers to remain competitive, and this could result in increase in imports and a decrease in exports, as the demand for high technology components could possibly not be met by local ACMs.

According to NAACAM (2014), a simplified system will increase 'buy-in' from all stakeholders, leading to increased effectiveness to reach the APDP objectives. Under its current form, the benefits of the APDP flow directly to the OEMs. The OEMs are supposed to take into account the value of the production incentive (PI) when setting price targets for the local component manufacturers. However, according to NAACAM (2014), often there is no such transparency in the price negotiation process as well as the rand value of the PI ceded to the OEMs.

2.6.7 Rationale for domestic motor vehicle manufacturers sourcing their automotive components from abroad

According to Deloitte (2013), despite the incentives offered by the APDP to local OEMs to source their components from locally based ACMs, many of them purchase automotive components from outside of South Africa because the local ACMs are not ready to supply innovative components that have flexibility in product development. This is due to the low levels of investment in research and development by the local ACMs. According to Buys (2013), the R&D efforts by automotive component manufacturers in South Africa was generally low in 2013: approximately 51% of ACMs had no R&D budgets; of the remaining ACMs, an average of 1.8% of personnel were involved in R&D, and an average of only 1.55% of total sales revenue was allocated to R&D related activities.

Another reason for motor vehicle manufacturers to source their components from abroad is because of the parent company's relationship with the global component manufacturers. For example, if VW or BMW in Germany choose Bosch to supply them with automotive components for vehicles manufactured in Germany, they will expect other VW and BMW plants located in other parts of the world to also source these products from Bosch (Naude 2009).

According to Niyimbanira (2013), South Africa's labour productivity stalled for the past 20 years, whereas that of the world has grown on average by 25%. Furthermore, labour unrest has contributed to the poor productivity of local ACMs, and, to ensure regular supplies, many local vehicle manufacturers source their products from foreign suppliers. According to Armentano (2013), poor productivity, coupled with relatively high wages and salaries, have contributed to South African ACMs failing to maintain a globally competitive position. Apart from the above, there are other challenges impacting on the ability of local ACMs to compete globally, and these shall be discussed below.

2.6.8 Challenges impacting on the competitiveness of South African automotive component manufacturers

According to Lorentzen and Barnes (2013), from a global perspective the South African automotive component manufacturing industry is faced with some of the most difficult and challenging circumstances. Pires and Neto (2008) noted that the South African automotive industry has experienced strong competition on a global scale in highly competitive markets, and it has been challenged to face issues such as:

- strong pressure for price and delivery time reductions;
- quality and overall customer service improvements;
- environmentally friendly products, a substantial reduction in product life cycles;
- the rapid introduction of new products;
- a reduction in the time-to-market and product development costs;
- the pressure to supply new markets both in geographical terms and in terms of new products, and
- the strengthening of relationships.

Due to the increasing number of vehicle models being introduced into segmented markets, managers are seeking both growth and cost reductions to make their companies more competitive and profitable. Ambe and Badenhorst-Wess (2013) argue that the automotive component manufacturing industry is challenged to maintain its position in the market, to produce at a competitive cost and to have the ability to respond quickly and reliably to first-world market demands.

Communication channels between OEMs and other supply chain partners remain manual in many cases. According to Kehbila, Ertel and Brent (2009), this is especially true in the case of small suppliers unable to afford an investment in electronic data interchange (EDI) technology that is used between OEMs and their larger suppliers. In addition, the authors state that logistics operations in the automotive supply chain are complex and represent a major expense and opportunity for improvement.

According to Charles and Chucks (2012), organisationally, the relations between vehicle assemblers and component and part suppliers is one of the most complex in any industry. Not only have assemblers passed on substantial responsibilities in product development to upper-tier suppliers, the latter are also expected to guarantee quality standards and delivery schedules of their own lower-tier suppliers, whose parts and components feed into their modules and systems.

Other challenges impacting on the competitiveness of ACMs in South Africa are discussed below.

2.6.8.1 Poor quality of education

The quality of education at many public schools in South Africa, especially those in the townships and in the rural areas, is poor, and this negatively impacts on the ability of matriculants to access and succeed in their tertiary studies. This also increase the training and development costs of ACMs. According to Radas and Božić (2009), radical innovations and overall competitiveness require a higher level of advanced knowledge and expertise that can only be achieved by working closely with advanced academic and research institutions. By working with well-resourced academic and research institutions, it is possible to improve overall efficiency and competitiveness as a result of benefits derived from advanced theoretical knowledge, specialized equipment and findings from research and development activities.

2.6.8.2 The shortage of skilled workers

Alfaro *et al.* (2012), stated that one of the major challenges facing South African ACMs is the shortage of highly skilled workers. According to the Economist Intelligence Unit (2011), South Africa had 194 technicians and 821 researchers per million inhabitants, while Brazil had 976 technicians and 1100 researchers per million inhabitants; Turkey had 160 technicians and 1593 researchers per million inhabitants, and Thailand had 283 technicians and 573 researchers per million inhabitants. To make matters worse, many skilled workers are leaving South Africa to settle in other first world countries. According to Black (2009), the shortage of skilled workers negatively impacts on the

performance of local automotive manufacturers in South Africa, and in a study undertaken among ACMs by Naude and Badenhorst-Weiss (2011), approximately 58% of the respondents cited the shortage of highly skilled workers as being a major challenge.

2.6.8.3 Industrial action and strikes

Trade Unions in South Africa are highly militant and politicized, and the National Union of Metalworkers of South Africa (MUMSA), which represents employees in the automotive industry, is no exception. Generally, labour disputes in South Africa take time to resolve, and this impacts negatively on the ability of ACMs to produce components at a competitive cost and to respond quickly and reliably to first-world market demands (Naude 2013).

Cokayne (2013) revealed that the three week strike by the members of NUMSA, which began in September 2013, affected the seven major local motor vehicle manufacturing plants (BMW, Ford Motor Company, General Motors, Mercedes-Benz, Nissan, Toyota and Volkswagen). According to the NAAMSA report (2013a) the four week secondary strike by the component manufacturing industry had stopped production operations at the seven motor vehicle manufacturers, due to the unavailability of locally produced components from its suppliers.

According to Matai (2013) the strike action, which costs the automotive industry approximately R 700 million per day, resulted in lower economic growth, lower domestic and export sales, a reduction in industry profitability, loss of income to workers, and loss of revenue to the fiscus. NAAMSA (2013a) suggests that regular strike action had damaged South Africa's status as a reliable supplier to international export markets. In July 2016, NUMSA was demanding a one-year, rather than a three-year wage agreement, and a 20% wage increase. This unreasonable demand could negatively affect future export contracts being awarded to South African automotive manufacturers and automotive component manufacturers, and future investment decisions. African countries such as Morocco, Kenya and Nigeria are also competing for new automotive investments, and are perceived as being more stable.

2.6.8.4 The effect of HIV/Aids

According to AIDC report (2014) on the 1 April 2014, the Human Sciences Research Council released its National HIV Prevalence, Incidence and Behaviour Survey which showed that 6.4 million people, representing 12.2 percent of the South African population, were living with HIV. HIV/AIDS have adversely affected both the productivity and the profitability of ACMs, due to:

- employee absenteeism;
- sick workers being less productive at work;
- accidents occurring more frequently because of fatigue and poor concentration in the workplace, and
- loss of skilled workers who die or retire on medical grounds, having to be replaced; firms find it difficult to recruit experienced replacements and as a result have to employ workers who are inexperienced and need to be trained at a great cost.

According to the AIDC Report (2009), there is also not enough information as to how many employees are burdened by family members who are HIV positive. These employees experience great difficulty in focusing and being effective at work.

2.6.8.5 The high costs of security

Crime is a big concern for all businesses in South Africa, and the costs of installing and monitoring surveillance cameras, armed response security guards, alarm systems and day and night security guards, increase the cost of doing business in South Africa. In a survey conducted by International Business Report in 2011, half of the local businesses cited financial losses due to crime as a critical component affecting their businesses; 48 percent stated increasing costs of security affected their business

operations, and 56 percent of owners noted the high crime rate as the number one reason that would cause them to emigrate (de Groot & Smit 2015).

In addition to the costs outlined above, the cost of insurance, and combating cybercrime a major challenge for ACMs. According to Rau (Kolver 2014a) of the South African Chamber of Commerce and Industry (SACCI), crimes against businesses is increasing, in 2013/14 there was a 13% increase in robberies at business premises, (92 215 incidents), which translated into approximately R500-million in lost production, excluding replacement and repair costs.

2.6.8.6 Other cost challenges impacting on the competitiveness of local ACMs

Naude (2013) states that ACMs play a crucial role in ensuring the survival and competitiveness of the automotive industry in South Africa, by ensuring that they contribute to the cost competitiveness of South African vehicle manufacturers. However, apart from some of the challenges identified earlier, which translate into increased costs, local ACMs have to contend with high fuel costs, costs incurred due to delays at ports; and the high prices of components and materials that are imported, due to the deteriorating rand/dollar exchange rate. Given the strong bargaining power of the buyers, i.e. the motor vehicle manufacturers, they cannot easily pass on the cost increases to them.

2.7 Conclusion

The chapter discussed the important aspects related to innovation as well as the automotive sector in South Africa, more especially, the automotive component industry. After the liberalisation of the South African automotive industry and the reintegration of local vehicle manufacturers with their global parent companies, local ACMs were exposed to the harsh realities of global competition. The fact that over 70% of the ACMs in Gauteng have been in operation for more than 15 years indicates that many of the ACMs have adapted to global competition. However, if local ACMs

wish to be the main suppliers to local vehicle manufacturers, they must become more innovative.

In the next chapter (chapter three) the research methodology and design employed for this study will be discussed.

CHAPTER THREE
RESEARCH METHODOLOGY AND DESIGN

3.1 Introduction

The chapter begins by restating the aims and objectives of the study, as they were not addressed by the literature reviewed in the previous chapter. Thereafter, the following aspects pertaining to the research methodology used for the empirical study are outlined: the target population, data collection; questionnaire design; data analysis; validity; reliability, and ethical considerations.

3.2 Aims and objectives of the study

The aim of this study was to examine the nature and extent to which automotive component manufacturers (ACMs) in Gauteng adopted innovative strategies to enhance their competitiveness.

The objectives of the study were:

- to establish the nature and extent to which an innovative culture existed amongst automotive component manufacturers in Gauteng;

- to examine the nature and extent to which automotive component manufacturers in Gauteng used innovative strategies in their manufacturing processes;

- to investigate the impact of innovative strategies on new product development among ACMs in Gauteng; and to recommend innovative strategies which ACMs in Gauteng may use to improve their competitiveness.

3.3 The Research Design

According to Welman, Kruger and Mitchell (2009), research design refers to the plan that a researcher uses to obtain and collect information from the research participants.

A quantitative research methodology was selected for the purpose of this study. Bailey (2008) states that when research is considered at a fixed time, as in this case, where the organisations were surveyed within a period of three weeks, the research lends itself to a cross-sectional research methodology.

For the current study, a census was conducted in gathering data in order to achieve the objectives of the study. The approach to this study was a formal, objective, systematic process in which numerical data was sourced through a questionnaire. The data was analysed, and the results were used to obtain an understanding of the nature and extent to which innovative strategies were used by the automotive component manufacturers (ACMs) in Gauteng, South Africa.

3.4 Target population

The current study was conducted among all the automotive component manufacturers located in Gauteng, one of the nine provinces in the Republic of South Africa. The largest concentration of automotive component manufacturers (approximately 40%), as well as three of the seven motor vehicle manufacturers in South Africa, namely, BMW, Ford and Nissan, are located in the above-mentioned province. As the target population consisted of approximately 70 automotive component manufacturers, it was decided to conduct a census; i.e., the entire population was surveyed. Hence, there was no sampling involved in this study.

3.5 Questionnaire Design

The questionnaire design is a critical component of a research project in that a poorly designed questionnaire can be a major source of error in the final research results. In designing a questionnaire, a decision on how to structure the questionnaire is important because it specifies how information will be obtained (Tustin, Ligthelm, Martins & Van Wyk 2005).

The OECD (2004) recommends that a questionnaire must specify the measures for conducting and obtaining information needed to structure and/or solve research problems. The questionnaire for this study consisted mainly of closed-ended questions

and a few open-ended questions, and was adapted from a questionnaire used in a study undertaken by Moses, Sithole, Blankley, Labadarios, Makelane & Nkobole (2012).

When designing the questionnaire, the researcher took into consideration the following guidelines, as proposed by Milton (2014):

- the questions are not invasive regarding confidential data;
- the questions are not leading or make the respondent feel embarrassed or humiliated;
- the questions are not so complex that respondents are required to do research before answering the questions;
- the questions are clear and comprehensive;
- the questions only require one response at a time;
- the questionnaire is not too long to discourage the respondent from completing the questionnaire, and
- the structure and content of the questionnaire was based on the research objectives and literature reviewed.

A Likert scale is a summarised rating scale which consists of the statements that express either an agreeable or disagreeable response towards the objects investigated. A five-point Likert scale was used for most questions, where the respondents were required to indicate the extent to which they agreed or disagreed with a statement by ticking the appropriate column (Cooper 2006).

3.6 Data Collection

When conducting research, researchers use two types of data, namely primary and secondary data. Primary data is new data collected for the purpose of the particular study, and secondary data is data that has already been collected for some other previous purpose but which can still be used in the new study (Saunders *et al.* 2009). These authors maintain that in order to answer the research questions and to meet the set objectives, a combination of primary and secondary data is often required (Saunders *et al*. 2009).

Primary data for this study was collected by means of a structured questionnaire that was e-mailed to the managers of the ACMs based in Gauteng. Secondary data was obtained from academic books, research studies, journals, newspapers articles and electronic media. The questionnaires were distributed to the 70 ACMs in the form of a hyper-text-mark-up-link contained in an electronic mail. Three follow-up e-mail requests to participate in the study were made, with the view to increasing the response rate. This was also complemented by personal visits to selected ACMs. Fifty fully-completed questionnaires were received from the ACMs surveyed, representing a response rate of 71.4%, which was considered good.

3.7 Pilot Study

Barry (2011) emphasises the importance of conducting a pilot study "to validate and pre-test" the measuring instrument before proceeding to the actual data collection. The pilot study was conducted to remove ambiguous questions and to test the validity of the questionnaire before the actual data collection. According to Saunders *et al*. (2009), another important objective of the pilot study is to ensure that the data collected from the respondents can be statistically analysed and that logical conclusions can be obtained from the processed data. The pilot questionnaire was administered to five randomly selected ACMs within the study area. After collecting the completed questionnaires, a few questions were identified as being ambiguous and redundant, and the questionnaire was revised accordingly.

3.8 Reliability

Reliability refers to the extent to which the data collection techniques or analysis procedures will yield consistent and accurate findings (Saunders *et al*. 2009). For this study, the reliability of the questionnaire was measured by calculating the Cronbach Alpha value of the study. According to Greenwood and Levin (2011), reliability and validity in research function as the researcher's shield. The primary concern of any researcher is that the findings of the study are reliable and valid.

Welman, Kruger and Mitchell (2005:188) state that in determining whether research findings are reliable, the researcher should be able to answer the following question: “will the evidence and conclusion stand up to close scrutiny?” A further point on reliability is that if anyone else were to repeat the research, he or she should be able to obtain the same results as those obtained originally. Leading and subjective questions should also be avoided in an effort to ensure reliability.

According to Newbold, Carlson and Thorne (2012), the two most important aspects of precision are reliability and validity. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.71 or higher is considered as “acceptable”, and for this study, the overall reliability score was 0.929.

3.9 Validity

According to McNeill and Chapman (2005), validity refers to an inspection as to whether or not the collected data relate to what is being studied. McGivern (2006:79) maintains that “validity is a key concept in assessing the quality of research”. Validity is explained as the correctness of a description, conclusion, explanation or interpretation - in other words, how well the collected data has been investigated and interpreted.

To ensure validity, the researcher adhered to the following recommendations, which were proposed by Welman *et al* (2005):

- prepare a well–designed research instrument so that it fully addresses the research objectives of the study;
- ensure that as large as possible a response rate is achieved from the study area;
- undertake a pilot test to help eliminate errors or ambiguity, and
- do not engage in inaccurate or misleading measurement practices.

3.10 Analysis of Data

According to Yin (2003), “data analysis is the process of bringing order, structure and interpretation to the mass of collected data”. Zikmund-Fisher, Fagerlin and Ubel (2010) state that data analysis usually involves reducing accumulated data to a manageable size; developing summaries; looking for patterns; and applying statistical techniques. The completed questionnaires were sorted and codified, and the raw data was captured on a Microsoft Excel spreadsheet. The data from the completed questionnaires was analysed using the latest version of the Statistical Programme for Social Sciences (SPSS) software programme, and the results were presented using frequencies, percentages, bar charts, pie charts and tables.

In descriptive research the major emphasis is on determining the frequency with which something occurs or the extent to which two variables co-vary. According to Cooper and Schindler (2003), descriptive research is more formalised and typically structured with clearly stated hypotheses or investigative questions. Hence, it is marked by a clear statement of the problem and specific hypotheses, or alternatively, an unproven statement and detailed information needed (Malhotra 2004).

This study did not involve inferential statistical analyses, as a census was undertaken, with the entire target population being surveyed.

3.11 Ethical considerations

When conducting research, especially involving human subjects, it is important to consider ethical issues (Koller 2008). Considering ethical issues may help assure trust from the respondents, who may be motivated to contribute more openly to the research (Israel and Hay 2006).

Informed consent relates to the principle of voluntary participation in research (McGivern 2006; Gray, Williamson, Karp & Dalphin 2007). The researcher ensured that the research maintained its ethical integrity by:

- sending a letter of information and consent to respondents prior to participation;

- not invading the privacy of the respondents;

- acknowledging all references used in the study;

- not engaging in any deceptive means to gather data from respondents, and

- ensuring that the respondents were treated with respect and courtesy during the research process.

According to McGivern (2006) and Gray *et al*. (2007), ensuring the anonymity and confidentiality of participants and the data they provide are two ways in which the well-being and interests of respondents can be protected. In this regard, the researcher ensured anonymity and confidentiality by:

- not requiring respondents to identify themselves or their organisations;

- not requiring participants' e-mail addresses, and

- by providing a covering letter, signed by the researcher, assuring participants that the information provided will be kept confidential, and will be destroyed after a period of five years.

3.12 Conclusion

This chapter described the main aspects relating to the research methodology used in this study, as well as the activities that the researcher undertook to ensure that the research was both valid and reliable, and that ethical protocols were observed.

In the next chapter, the data collected from the research is presented, analysed and discussed.

CHAPTER FOUR: PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

In this chapter, the results of the study are presented, analysed and discussed. Data for the study have been obtained by analysing the responses to the questionnaires that were administered amongst automotive component manufacturers in Gauteng. A survey was conducted among the 70 ACMs located in Gauteng, and 50 full-completed questionnaires were returned to the researcher, representing a response rate of 71%, which was more than adequate to draw meaningful conclusions about the target population. The data collected from the responses was analysed using the *Statistical Package for the Social Sciences* (SPSS) version 23.0. For this study, the tolerance level of error, also referred to as the level of significance or “p value”-was set at 5% (0.05). This level of error represents the acceptable difference between the expected and actual population parameter values. The findings from the empirical study are presented, analysed, and discussed below, in the order in which the questions appeared in the questionnaire.

4.2 Customers targeted by Automotive Component Manufacturers

Automotive Component Manufacturers (ACMs) in Gauteng were asked to identify which one of the following customer groups they targeted, namely, automotive retailers and the aftermarket; Original Equipment Manufacturers (OEMs), and Original Equipment Suppliers (OESs). Their responses are reflected in Figure 4.1.

Figure 4.1 Target Market

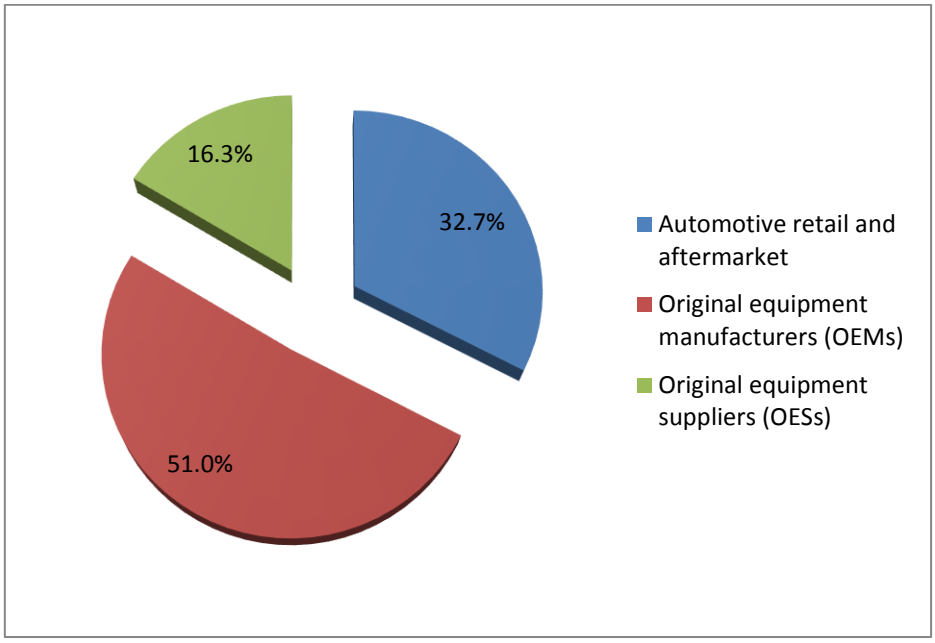
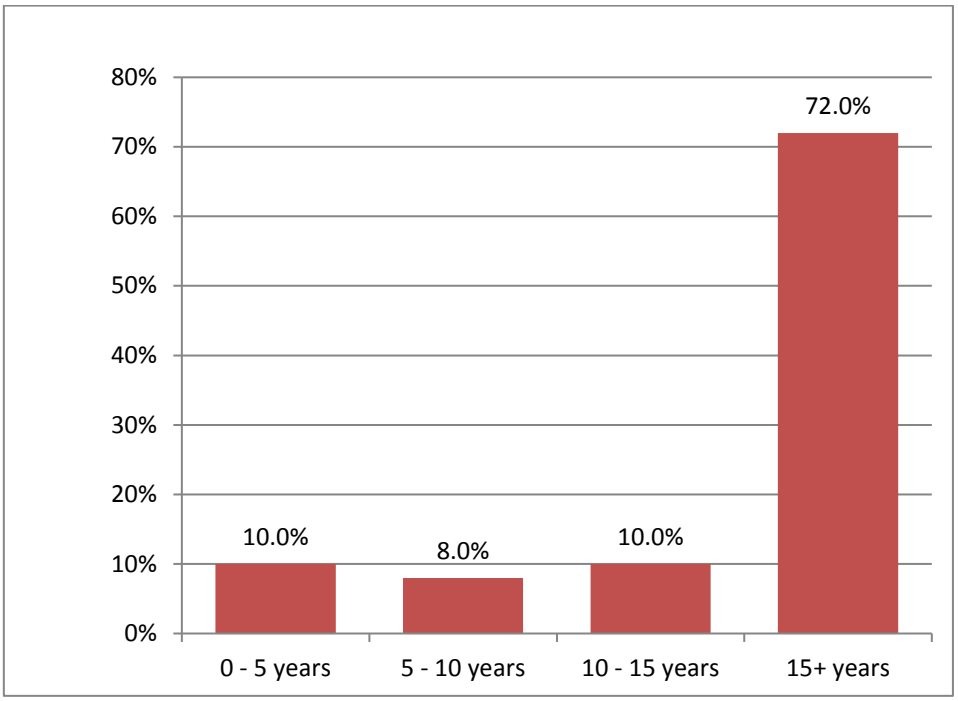


Figure 4.1 above shows that the majority of respondents (51%) targeted their products to motor vehicle manufacturers (OEMs). While 16.3% of the respondents supplied component parts to those organisations that manufactured original equipment for the motor vehicle manufacturers, approximately 33% of the ACMs targeted their products to the automotive retail and aftermarket sector.

4.3 Length of time ACMs in Gauteng were manufacturing automotive components

Figure 4.2 below indicates that the majority of respondents are well-established, with 72% of the ACMs supplying automotive components for more than 15 years, and 10% of the ACMs supplying automotive components for 10-15 years. The remaining 18% of ACMs in Gauteng have been supplying automotive components to OEMs, OESs, and/or the automotive retail and aftermarket sector for under 10 years.

Figure 4.2 Length of time ACMs were manufacturing automotive components



4.4 Vehicle categories supplied

The four vehicle categories for which ACMs manufacture component parts are: passenger cars, commercial vehicles, medium commercial vehicles, and heavy trucks, buses and coaches. Figure 4.3 below reflects the proportion of respondents who manufacture products for each of the aforementioned vehicle categories.

Figure 4.3 Vehicle Categories

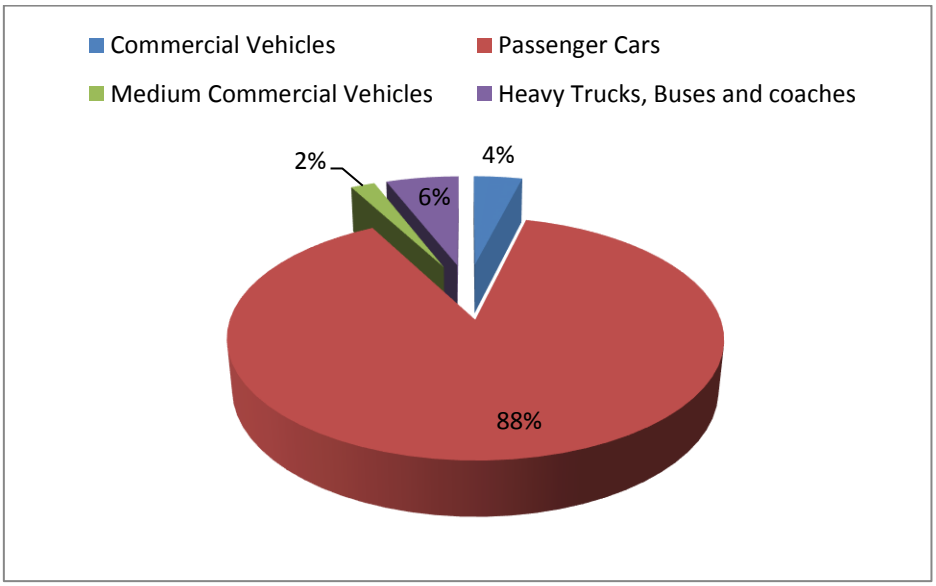
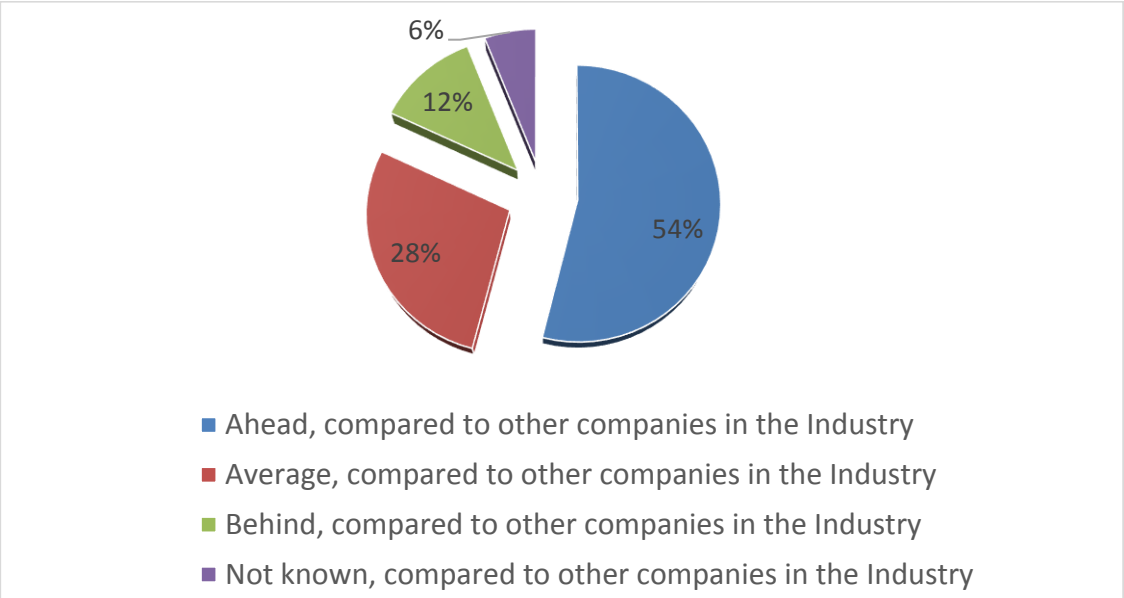


Figure 4.3 reveals that the majority (88%) of the Automotive Component Manufacturers in Gauteng were supplying component products for passenger cars and only 6% of ACMs were supplying component products for heavy duty trucks, buses and coaches. This is followed by 4% of respondents who indicated that they supplied components for commercial vehicles and only 2% of respondents who stated that they supplied components for medium commercial vehicles.

4.5 The status of machinery and equipment

The respondents were asked to indicate the status of their machinery and equipment, compared with those of other ACMs. The results are presented in Figure 4.4 below.

Figure 4.4 Status of Machinery and Equipment



More than half (54%) of the ACMs surveyed perceived that their equipment and machinery was superior to that of their competitors, while 28% of the respondents perceived their equipment and machinery to be on par with other companies in the industry. The above finding corresponds with the findings of a study undertaken by Charles and Chucks (2012), which revealed that South African ACMs invest huge resources in the acquisition of new machinery, in innovation and in the maintenance of equipment.

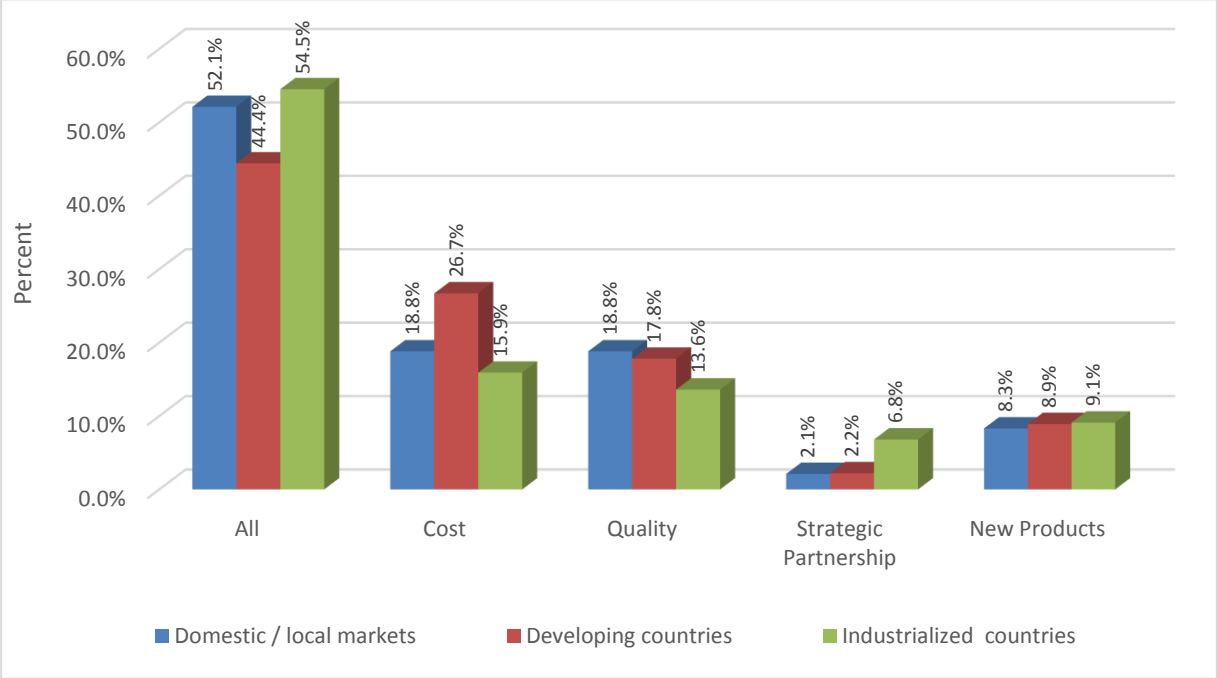
Significantly, 12% of the ACMs acknowledged that their equipment and machinery was inferior to those of their competitors. A study conducted by Spence (2006), indicated that, due to limited financial resources and limited economies of scale, many South African organisations were unable to secure the latest machinery and equipment. Also, the weakening of the rand against the dollar, has made the importation of new equipment and machinery very expensive.

4.6 Competitive strategies employed by ACMs

In competing in the domestic market, as well as in foreign markets in both developing and in developed countries, the respondents were required to identify which of the

following strategies, namely quality, cost, new products and strategic partnership, they employed. Their responses are presented in Figure 4.5 below.

Figure 4.5 Competitive strategies employed by Automotive Component Manufacturers



In competing in the domestic market, an equal proportion of respondents (18.8%) used cost and quality as a basis to compete, whereas 8.3% of respondents focused on the development of new products to give them a competitive edge, and 2.1% of respondents entered into a strategic partnership, most probably with a foreign-based manufacturer of automotive components.

In competing in developing countries, the largest proportion of respondents (26.7%) used cost as a basis to compete and approximately eighteen percent (17.8%) of the respondents used the quality of their products as a competitive weapon. Almost nine percent (8.9%) of respondents chose to gain a competitive advantage by developing new products and 2.2% entered into a strategic partnership with another in order manufacturer to enable them to compete in developing countries.

In competing in industrialised countries, approximately 16% of respondents followed a low cost strategy, while almost 14% focused on offering quality products to gain market share. With regard to using new product development as a basis to compete in industrialised countries, the percentage of respondents (9.1%) who followed this strategy is similar to the percentage of respondents who adopted this strategy in the domestic market (8.3%), as well as in developing countries, where this figure was 8.9%. If the local ACMs wish to gain a sustainable competitive advantage, it is important that they are in the forefront of innovation. Tidd and Bessant (2009) also observed that the pattern of competitive advantage is increasingly favouring those organisations that can mobilize knowledge and technological skills and experience to create novelty in their offerings as well as in the ways in which they create and deliver.

From the analysis above, it is clear that the number of respondents who chose to compete in both the domestic market as well as in developing countries by adopting a low cost strategy, developing new products and entering into a strategic partnership, is almost identical. In a similar study conducted by Samsunlu (2007) amongst ACMs in Turkey, the findings reveal that ACMs in Turkey used various strategies to remain competitive locally and internationally, namely: improvement in technology; quality design; qualified workforce; improved performance; and strategic alliances and joint ventures.

4.7 Quality standards

Automotive component manufacturers usually produce components according to quality specifications set by their customers. The ACMs were requested to indicate the quality standards that they used and their responses are presented in Table 4.1 below.

Table 4.1 Quality standards employed by ACMs

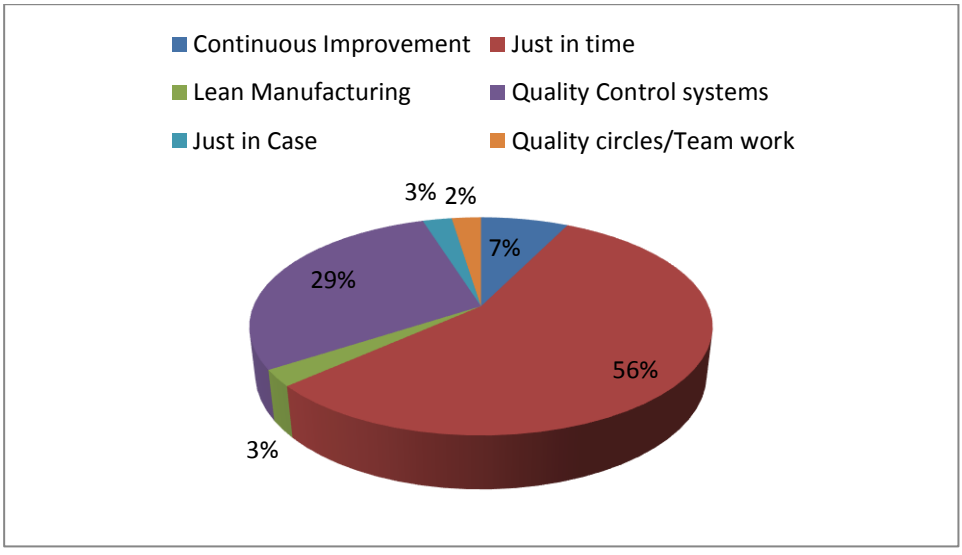
Quality Standards	Frequency	Percent
ISO	47	94%
ISO, TS1649	1	2%
ISO, TS16949	1	2%
ISO, TUV	1	2%
Total	**50**	**100%**

Table 4.1 shows that 94% of the respondents used ISO, while 2% used ISO, TS1649; 2% used ISO, TS16949; and a similar proportion of respondents used ISO, TUV.

4.8 Process innovation tools

World-class management philosophies and practices such as Just-In-Time production (JIT), Total Quality Management (TQM) and Continuous Improvement (CI) are already in use as process innovation tools. The respondents were requested to identify the process innovation tools which they used in their organisations, and the results are shown in Figure 4.6 below.

Figure 4.6 Process Innovation Tools



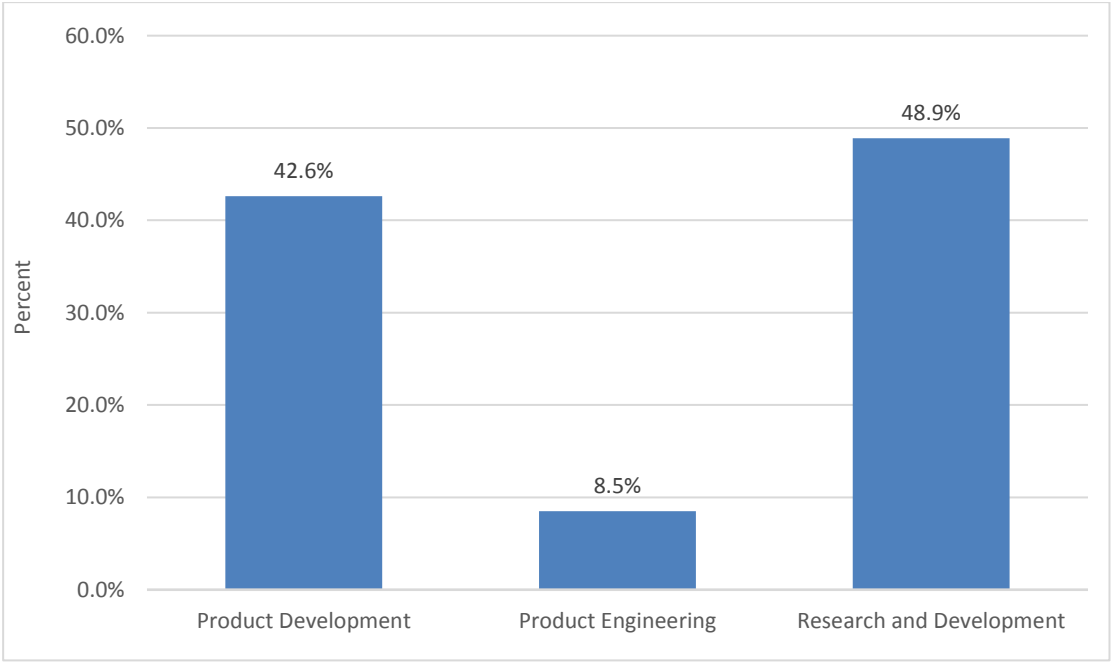
More than half (56%) of the ACMs surveyed used Just-in-Time (JIT); 29% used quality control systems; 7% used continuous improvement; 3% used lean manufacturing; 3% used just in case; and 2% of the respondents used quality circles/teamwork. Although Godin (2008b) contended that innovators needed to apply a combination of innovation tools, it seems that the ACMs in Gauteng used only one innovation tool.

In a similar study conducted in South Africa and India by Verimaak and Steyn (2013), it was found that 65% and 35% of ACMs in South Africa and India, respectively, used some form of process innovation tools within their organisations.

4.9 Existence of a Research and Development department; Product Development department or Product Engineering department

Respondents were asked to indicate whether they had an R&D department, a product development department or a product engineering department in their organisations. Figure 4.7 below reveals the respondents' results.

Figure 4.7. Existence of a Research & Development Department; Product Development Department or Product Engineering Department



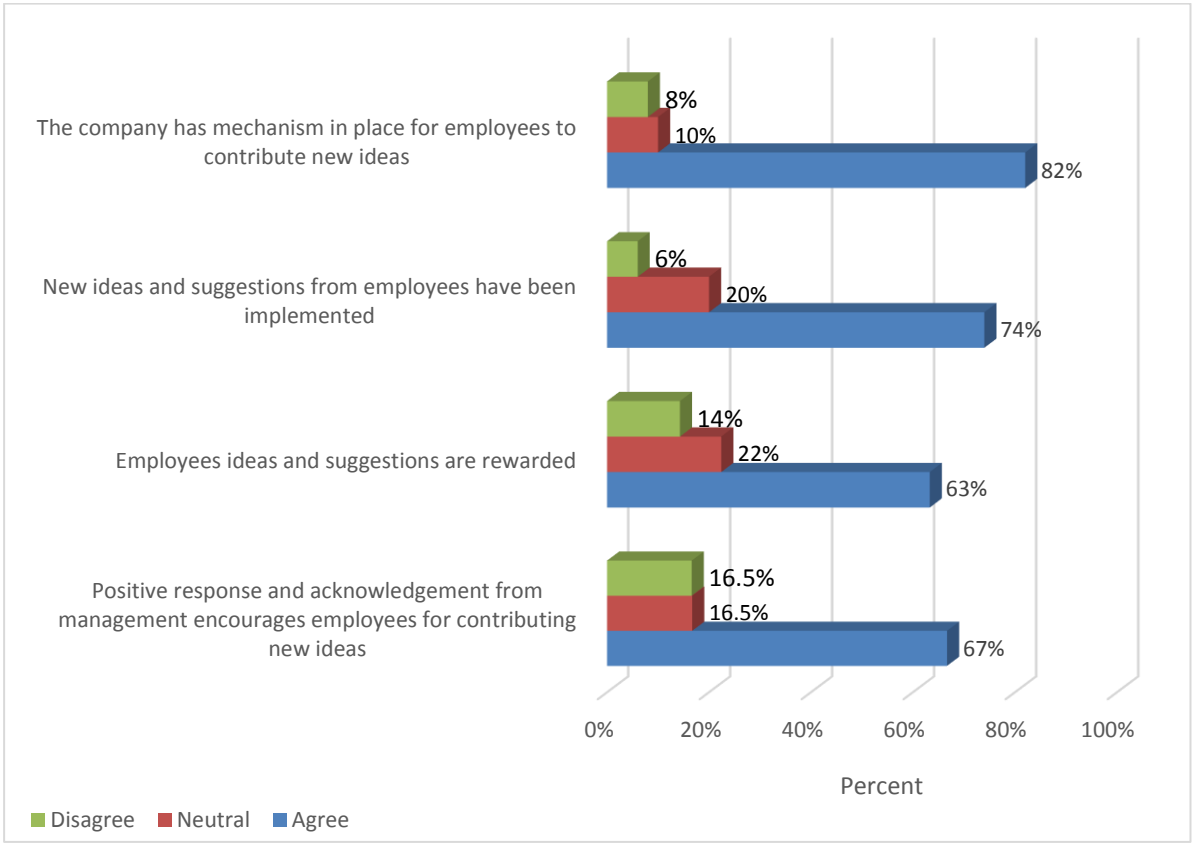
The largest proportion of respondents (48.9%) stated that their organisations had a Research and Development (R&D) department, whilst 43% of the ACMs in Gauteng stated that they had a Product Development division/department and approximately nine percent (8.5%) of respondents stated that they had a Product Engineering division/department in their organisations. The finding above is consistent with the finding from a study undertaken in 2013 amongst automotive component manufacturers in South Africa, which revealed that approximately 51% of ACMs did not have R&D departments/divisions (Buys 2013).

In a similar study conducted in Spain by Gonzalez, Miles-Touya and Pazo (2015), it was found that 60% of the respondents indicated that they had R&D departments. However, South Africa is classified as a developing country, whereas Spain is regarded as a developed country. Therefore, the finding that 48.9% of ACMs in Gauteng have R&D departments is encouraging. However, according to Alfaro et al. (2012) the termination of the Motor Industry Development Programme (MIDP) contributed to a decrease in R&D amongst South African ACMs, as the incentives for R&D from the Automotive Production and Development Programme (APDP), which replaced the MIDP, have not yet yielded the expected results, due to some unresolved issues with the APDP legislation and slow adoption by ACMs.

4.10 The role of employees in the development of new ideas

Respondents were required to indicate whether they agreed, disagreed or were neutral regarding four statements pertaining to the role of employees in their organisations in the development of new ideas. Their responses are reflected in Figure 4.8.

Figure 4.8 The role of employees in the development of new ideas



It can be seen from Figure 4.8 that 82% of respondents agreed that their organisations had mechanisms in place for employees to contribute new ideas; 8% disagreed with this statement, while 10% of respondents were neutral in this regard. The majority of respondents (74%) agreed with the statement that new ideas and suggestions from employees have been implemented, while 6% disagreed with this statement. While 63.3% of the respondents agreed with the statement that employee ideas and suggestions are rewarded, 14% respondents disagreed with this statement and a significant 22% were neutral in this regard. Approximately two-thirds (67%) of the respondents agreed with the statement that "acknowledgement from management encourages employees to contribute new ideas", while 17% disagreed with this statement.

There was a significant positive relationship between the responses to the statements that "The ACM has a mechanism in place for employees to contribute new ideas" and "New ideas and suggestions from employees have been implemented".

4.11 Procedures for developing new products

The respondents were required to choose one of four statements regarding the procedures for developing new products in their organisations, and their responses are shown in Figure 4.9 below.

Figure 4.9 Procedures for developing new products

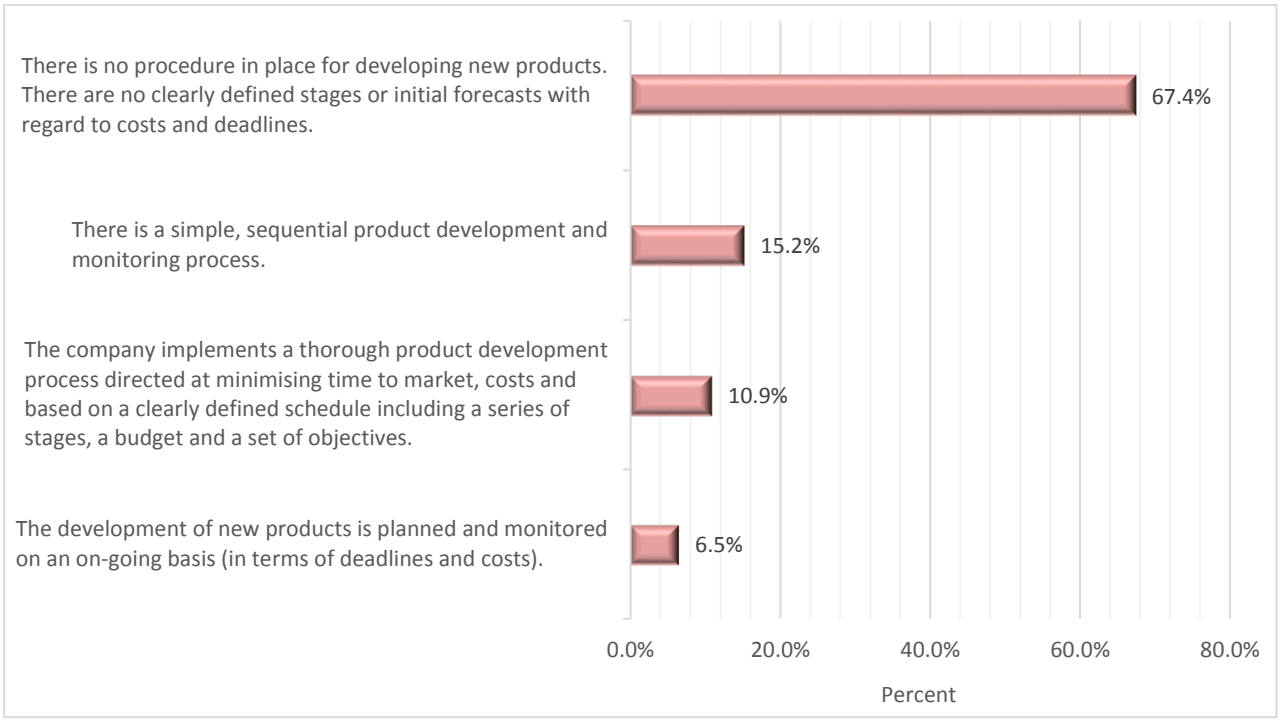


Figure 4.9 above shows that 67.4% of the respondents indicated that there were no procedures in place for developing new products. These respondents also indicated that there were no clearly defined stages or initial forecasts with regard to cost and deadlines. Only 10.9% of respondents indicated that their companies implemented a thorough product development process which was directed at minimising time-to-market costs and was based on a clearly defined schedule, including a series of stages, a budget and a set of objectives. Approximately 15% (15.2%) maintained that their organisations had a simple sequential product development and monitoring process, and 6.5% of the respondents indicated that the development of new products was planned and monitored on an on-going basis, in terms of deadlines and costs.

4.12 Use of product development tools

Figure 4.10 below present the result of the study with regards to the use of product development tools.

Figure 4.10 Use of product development tools

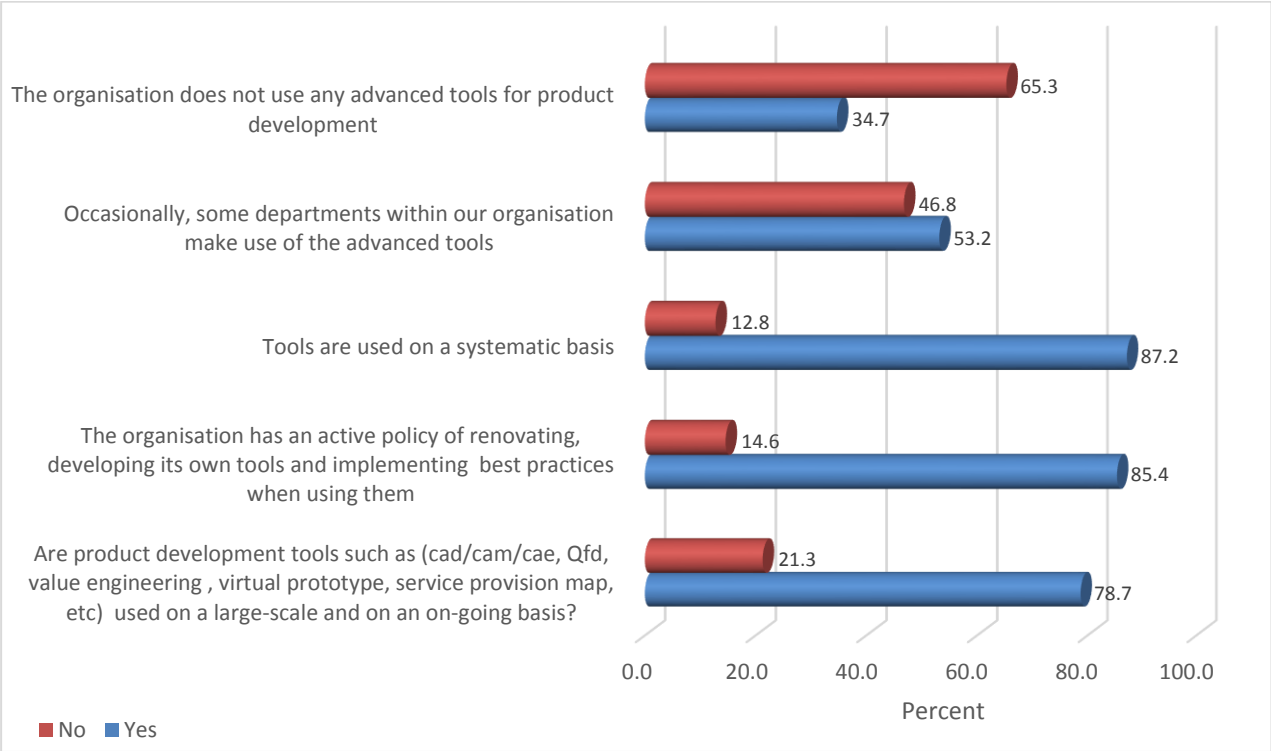


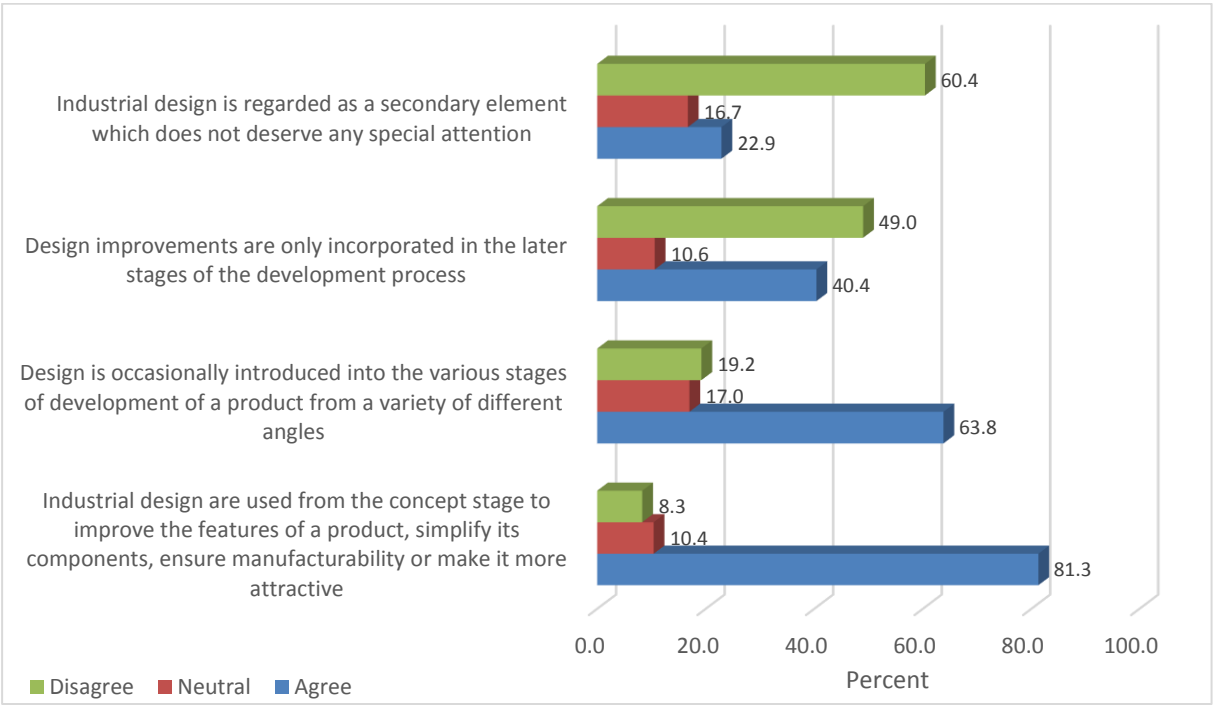
Figure 4.10 shows that 87.2% of the ACMs surveyed used product development tools on a systematic basis, while approximately 13% did not used these tools on a systematic basis. A significant 85.4% of the ACMs had an active policy of renovating and developing their own tools and implementing best practices when using them. Approximately 79% of the ACMs stated that they used the latest technological tools, such as computer aided design (CAD), computer aided manufacture (CAM), and computer aided engineering (CAE) for prototypes. Approximately 35% of the ACMs surveyed stated that they did not used advanced tools for product development, while approximately 53% stated that some departments within their organisations made use of these tools occasionally.

A correlation value of -.376 signified a weak relationship between the responses to the following statements: “The company gets its product ideas by studying its customers’ needs, involving other sectors in the company and systematic monitoring of both the activities and new products developed by its direct competitors” and “The organisation does not use any advanced tools for product development”. This value implied an inverse relationship, meaning that those organisations that source their product ideas by studying customer needs are less likely not to use advanced tools for product development.

4.13 Design of new products and processes

Four statements relating to the design of new products and processes were posed to the respondents. For each statement they were required to state whether they agreed, disagreed or remained neutral. The cumulative responses regarding each of the statements is shown in Figure 4.11 below.

Figure 4.11 Design of new products and processes



The majority of the respondents (81.3%) agreed with the statement that industrial design was used from the concept stage to improve the features of a product, simplify its components, ensure manufacturability or make it more attractive, whilst approximately 8% of the respondents disagreed with this statement and 10.4% remained neutral.

Approximately 64% of respondents stated that they have occasionally introduced design into various stages of product development, while 19.2% did not do so. A significant proportion (60.47%) of respondents disagreed with the statement that industrial design was regarded as a secondary element which did not deserve any special attention. Only 40% of the respondents agreed with the statement that design improvements are only incorporated in the later stages of the development process, while 49% of the respondents disagreed with this statement, and 10.5% remained neutral.

4.14 Sources of new product ideas

A number of statements were posed to the ACMs surveyed in order to establish the main sources of new product ideas, and their responses are showing Figure 4.12 below.

Figure 4.12 Sources of new product ideas

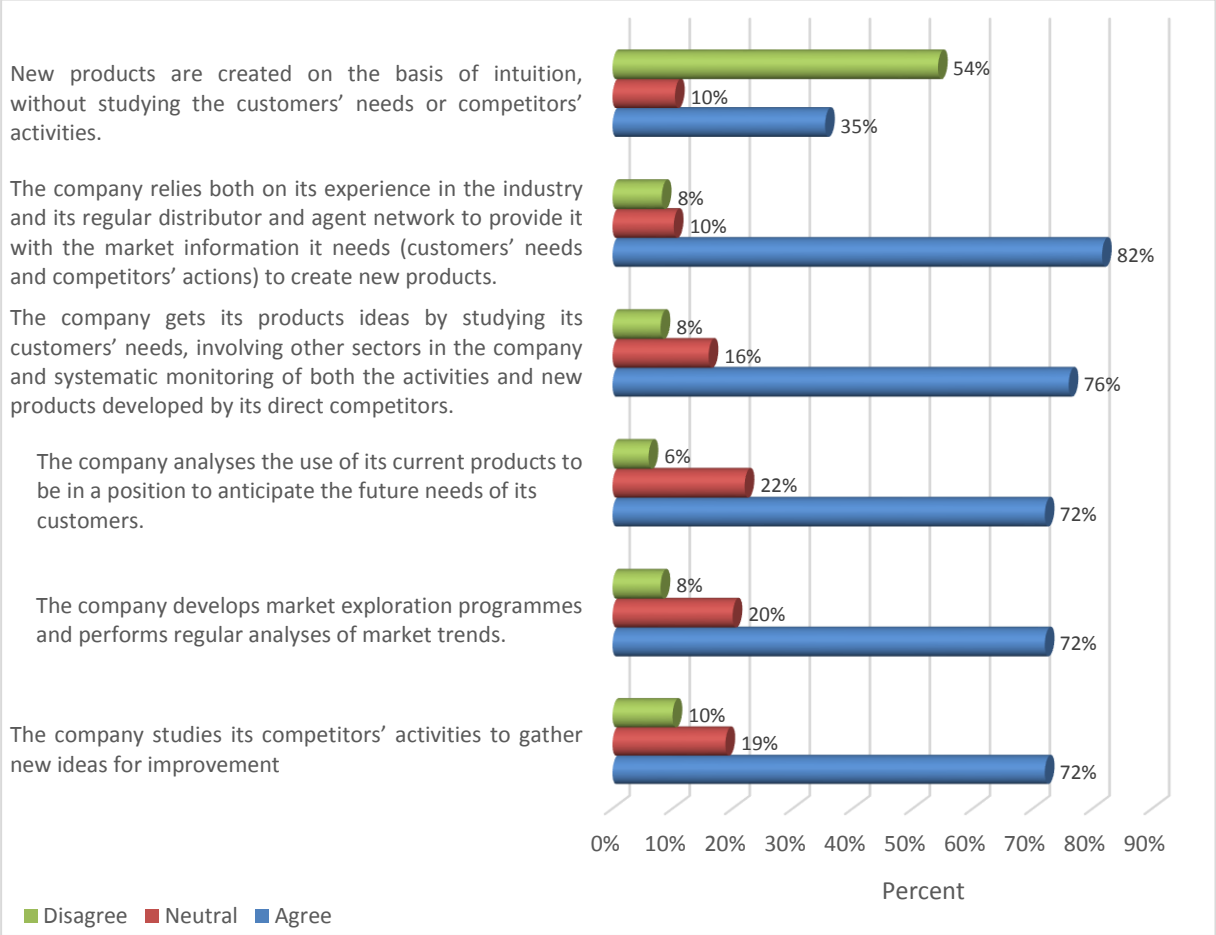


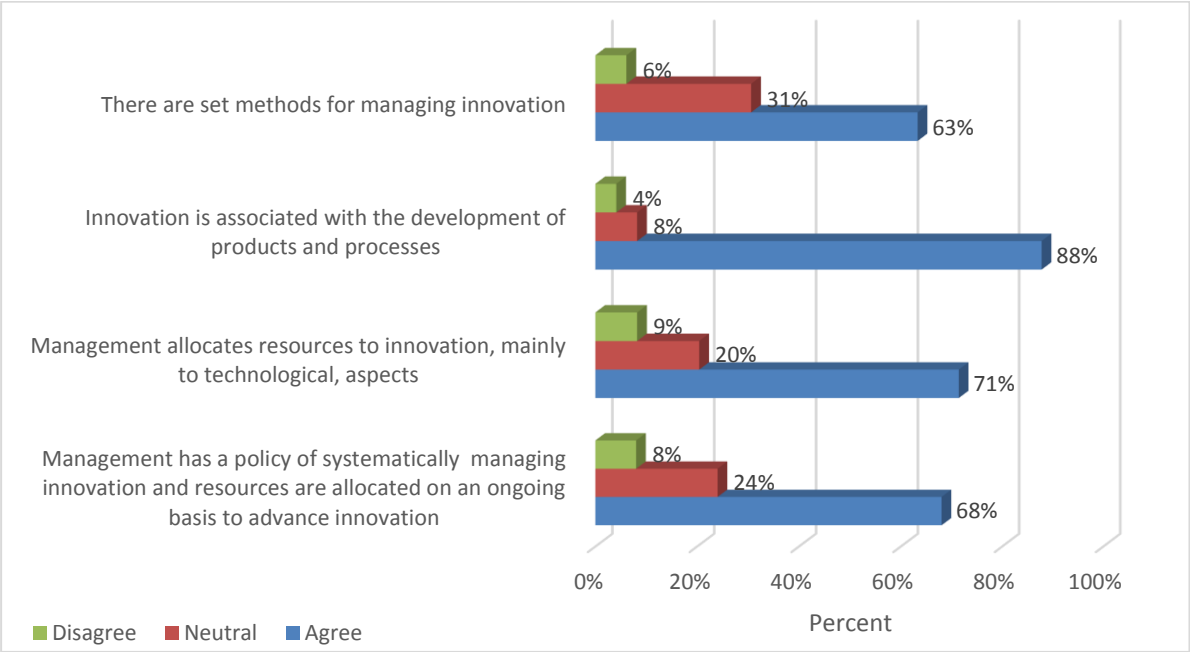
Figure 4.12 shows that 82% of the ACMs in Gauteng relied on their experience and regular distributor and agent networks for information in order to create new products, whilst 8% stated that they did not use this as a source of new product ideas. Over three quarters of the ACMs surveyed (76%) stated that new product ideas were sourced by studying the needs of their customers, who were either motor vehicle manufacturers, original equipment manufacturers or vehicle retailers or the aftermarket.

A significant number of ACMs (72%) sourced new product ideas by developing market exploration programmes and by regularly analysing market trends or by using their current products to anticipate the future needs of their customers. Surprisingly, a significant 35% of respondents stated that new products are created on the basis of intuition, without studying customer needs or analysing their competitors' activities.

4.15 Innovation management

With regards to innovation management, the respondents were asked to indicate how they managed their innovation. The results are reflected in Figure 4.13 below.

Figure 4.13 Innovation Management



As Figure 4.13 reveals, 88% of the ACMs in Gauteng associate innovation with product and process development, whereas 4% of the ACMs surveyed did not perceive an association between innovation and the development of products and process. The majority of respondents (71%) agreed with the statement that management allocates resources to innovation, mainly to technological aspects; 8% disagreed with this statement, whereas 20% of respondents were neutral in this regard.

Sixty-eight percent of the ACMs surveyed agreed with the statement that management had a policy of systematically managing innovation and that resources were allocated on an on-going basis to advance innovation; 8% of the respondents disagreed with this statement, while 24% were neutral in this regard.

Sixty-three percent of the ACMs in this study area stated that their organisations had set methods for innovation management, whereas 31% of the respondents disagreed with this statement, and the remaining 6% remained neutral.

4.16 Innovation strategies communicated by management

The participants were asked to give an indication of the innovation communication strategies used by management and the results are shown in Figure 4.14 below.

Figure 4.14 Innovation strategies communicated by Management

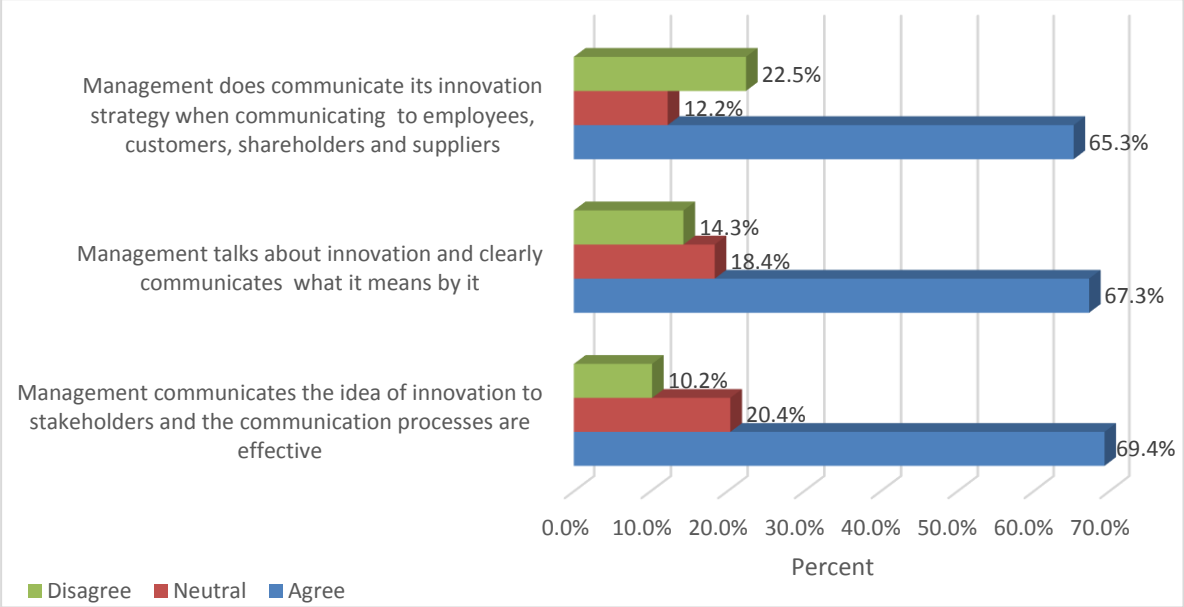


Figure 4.14 reveals that the majority of respondents (69.4%) agreed with the statement that management communicates the idea of innovation to stakeholders and that the communication processes were effective. However, 10.2% disagreed with this statement, while 20.4% of the respondents were neutral. Closely linked to the above result was the finding that 67.4% of the respondents indicated that their management talks about innovation and clearly communicates what it means by it. However 14.3% of respondents did not share this sentiment. Approximately 65% of the respondents stated that management communicated its innovation strategies to key stakeholders, while 22.5% stated that management did not communicate its innovation strategies with key stakeholders, and 12.2% of the respondents were neutral in regard.

4.17 Use of innovation tools

Respondents were asked to indicate how often innovation tools were used in their organisations, and their responses are shown in Figure 4.15 below.

Figure 4.15 Use of innovation tools

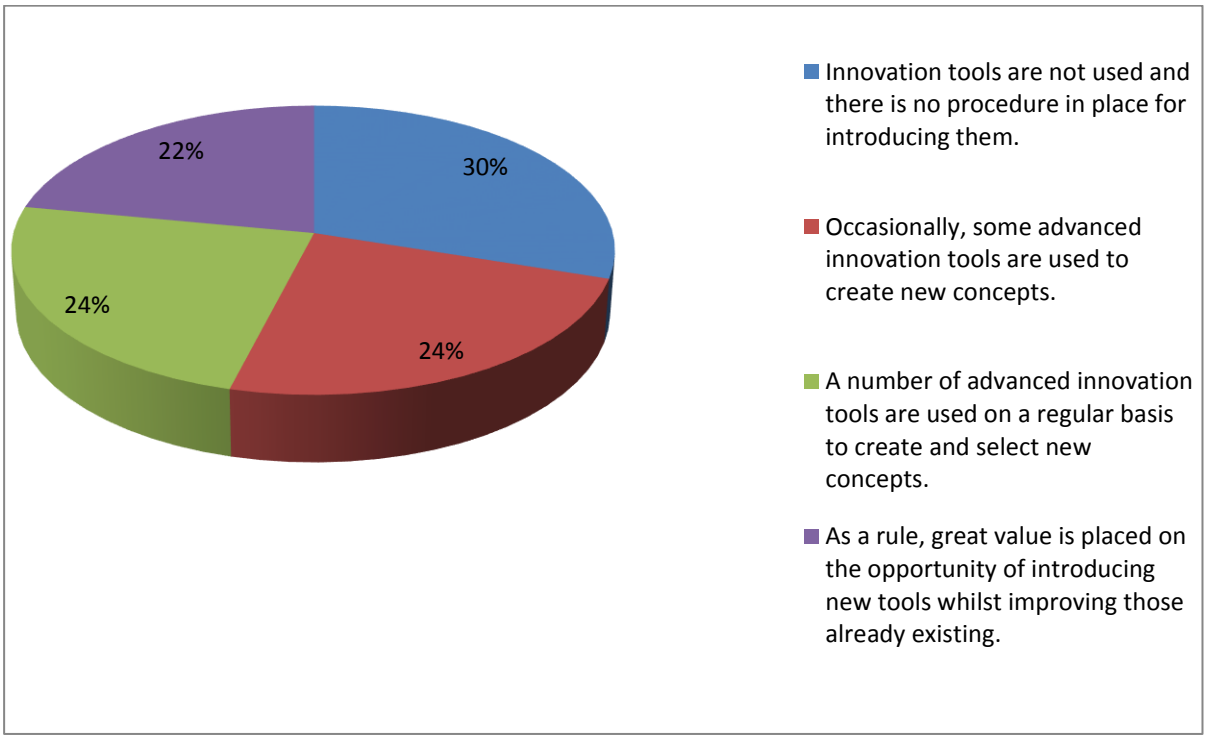


Figure 4.15 reveals that 30% of the ACMs in Gauteng were not using any innovation tools and that there were no procedures in place for introducing them. Twenty-two percent of the ACMs surveyed placed great value on the opportunity to introduce new tools, whilst improving the existing ones. Twenty-four percent of the respondents stated that they used a number of advanced innovation tools on a regular basis to create and select new concepts and an equal number of respondents stated that they occasionally used some innovation tools to create new concepts.

A study conducted by McPhee, Galbraith and Noori (2015) established that organisations needed innovation tools in order to manage the innovation process effectively; to understand the needs of their potential customers, and to develop products, services or processes that calibrate with market reality. The finding that a

significant number (30%) of the ACMs in Gauteng were not using any innovation tools, is cause for concern.

4.18 Relative importance of the sources of innovation and technology

The respondents were required to rank, in order of importance, seven sources of innovation, with 1 being the most important, and 7 being the least important, and the results are shown in Table 4.2 below.

Table 4.2 Ranking, in order of importance, of the sources of innovation and technology

SOURCE OF INNOVATION AND TECHNOLOGY	RANKING
Clients	1
Existing employees	2
Suppliers	3
Competitors	4
Consultancies	5
Government	6
Universities	7

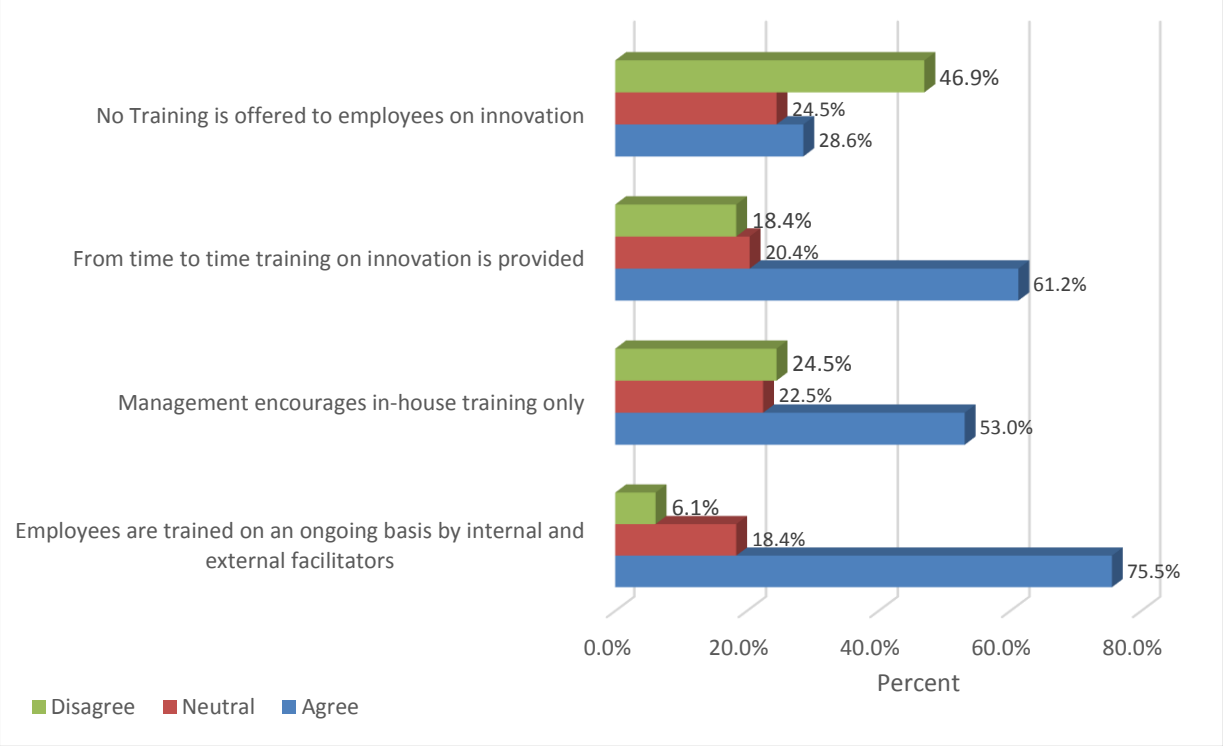
From the above Table, it can be seen that the ACMs surveyed ranked their clients, who include motor vehicle manufacturers and original equipment manufacturers, as the most important source of innovation. Existing employees were ranked second; suppliers were ranked third; and competitors were ranked fourth. Consulting companies, the government and universities were ranked fifth, sixth and seventh, respectively in terms of their importance as sources of innovation for the ACMs.

The above findings are consistent with the finding of a similar study conducted by Agostini and Cavaiggoili (2015) which revealed that customers (as current and future buyers) were the most important external source of knowledge required for the innovation process.

4.19 Innovation training offered during 2013–2014 by ACMs

Given the importance of innovation in the automotive sector, the study sought to establish the nature and frequency of innovation training offered by automobile component manufacturers in Gauteng in 2013 and 2014. The results are shown in Figure 4.16 below.

Figure 4.16: Frequency and nature of innovation training offered between/during 2013-2014



Approximately 47% of the respondents disagreed with the statement that “no training is offered to employees on innovation”, while 28.6% of the respondents agreed with this statement. However, a significant proportion of the respondents (24.5%) stated that they were not certain whether training was provided or not. Approximately 61% of respondents provided innovation training periodically, whereas 18.4% of the respondents did not provide innovation training periodically. Approximately 76% of the respondents stated that employees were trained on innovation on an on-going basis, and the training was conducted by both internal and external facilitators. Six percent of the respondents stated that they did not offer internal and external training

to their employees on an on-going basis, and 18.4% of the respondents were neutral with regard to the above.

The finding that the majority of respondents offered training to their employees on an on-going basis is encouraging, and is consistent with Ambe's (2012) argument that it is extremely important that if the local ACMs wish to survive and grow in the highly competitive automotive industry, adequate resources are budgeted for training per se, especially for innovation training.

4.20 Types of innovation introduced during 2013-2014 by ACMs

With regards to the introduction of innovation during 2013 to 2014, the respondents were asked to indicate, with regard to process -, product -, and organisational-innovation, whether the innovation introduced was new to the world; new to the domestic market, or new to the organisation. The responses were collated, and are presented in Table 4.3 below:

Table 4.3: Types of innovation introduced by ACMs in Gauteng during 2013-2014

Degree of Novelty		New to the World	New to the Domestic Market	New to the Firm
PROCESS INNOVATION	New or significantly improved methods of manufacturing	22.9%	27.1%	50.0%
	New or significantly improved logistics	10.6%	51.1%	38.3%
PRODUCT INNOVATION	New or significantly improved service	17.4%	54.3%	28.3%
	New or significantly improved products	23.9%	50.0%	26.1%
ORGANISATIONAL INNOVATION	New internal management practices	11.4%	52.3%	36.3%
	New methods of organising external relations	6.8%	50.0%	43.2%

4.20.1 Process innovation

From an analysis of the data in Table 4.3 above, it emerges that for the period 2013-2014, half (50%) of the ACMs surveyed had introduced new or significantly improved

manufacturing methods which were new to the firm; 27.1% had introduced manufacturing methods which were new to the domestic market (South Africa), and approximately 23% had introduced manufacturing methods which were new to the world. With regard to logistics, which plays an important role in the automotive sector, 38.3 % of respondents had introduced logistics processes which were new to the firm and a significant number of ACMs (51.1%) had introduced logistical processes which were new to the domestic market. 10.6% of the respondents stated that they had introduced logistical processes during 2013-3014 which were new to the world.

In a study conducted by Vermaak and Steyn (2013) amongst ACMs in South Africa, they found that 65% of the respondents had introduced new or significantly improved methods of manufacturing which were new to the domestic market, whereas the current study found that a much smaller proportion of respondents (27.1%) had introduced new or significantly improved manufacturing methods which were new to the domestic market. However, the lower figure for the current study may also be due to the fact that the study conducted by Vermaak and Steyn was undertaken amongst ACMs across South Africa, whereas the current study was limited to ACMs in one province only, namely, Gauteng.

4.20.2 Product Innovation

With regard to the development of new products and services during 2013-2014, an analysis of the data in Table 4.3 above shows that a significant proportion (23.9%) of ACMs surveyed in Gauteng had developed products which were new to the world, while 50% of respondents developed products which were new to the domestic market and 26.1% developed products which were new to the firm. 17.4% of the respondents indicated that they introduced services which were new to the world, while 54.3% of the respondents introduced new or significantly improved services which was viewed as being new to the domestic market, and 28.3% of the respondents stated that they introduced new or significantly improved services, which were new to the firm.

4.20.3 Organisational Innovation

With regard to organisational innovation, Table 4.3 shows that 52.3% of respondents indicated that new internal management innovation practices that were introduced were new to the domestic market, while 36.3% of respondents indicated that internal management practices that were introduced to their firms in 2013-2014 were new to the firm and 11.4% of the respondents indicated that new internal management innovation practices that were introduced were new to the world. Fifty percent of the respondents indicated that the methods used to organise external relations were new to the domestic market, while 43.2% indicated that they were new to the firm, and 6.8% indicated that these methods were new to the world.

4.21 Impact of Innovation on the Organisation

Respondents were required to agree, disagree, or remain neutral towards four statements relating to the impact of innovation on their organisations, and their collated responses to each of these statements is shown in Figure 4.17 below:

Figure 4.17 Impact of Innovation on the Organisation

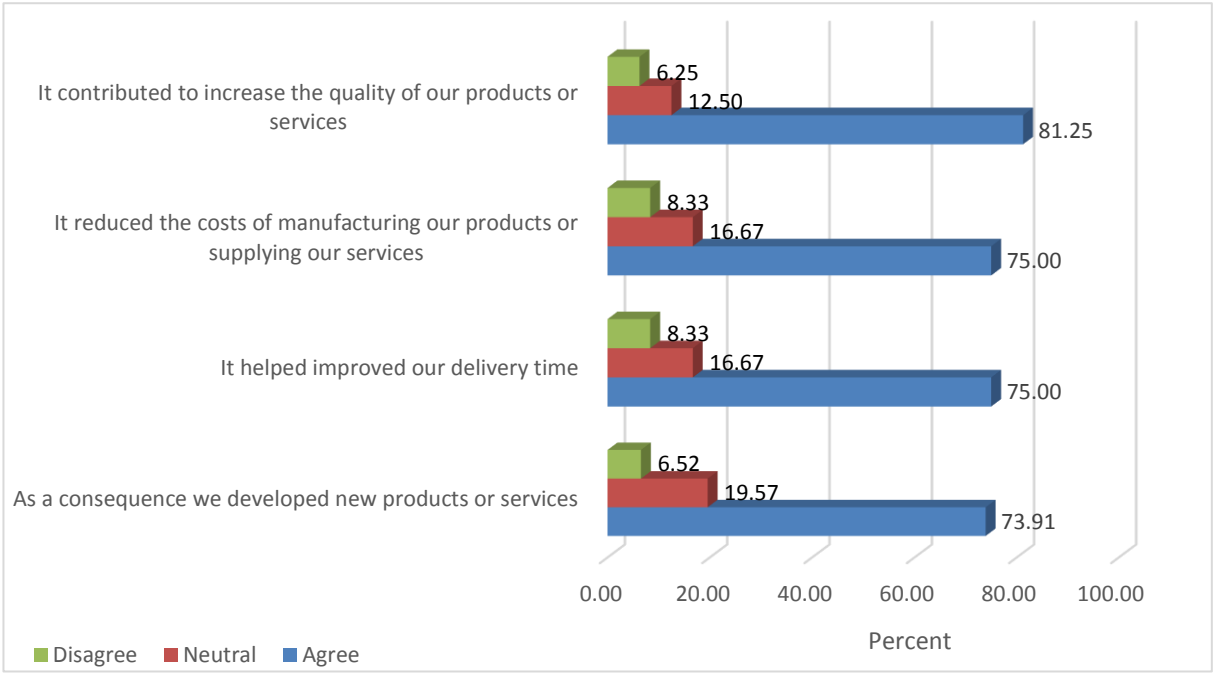


Figure 4.17 shows that the majority of respondents (81.25%) agreed with the statement that innovation contributed to an increase in the quality of their products and services, and 12.5% of the respondents were neutral in this regard. Three quarters of the respondents agreed with the statement that innovation resulted in a reduction in their manufacturing and supply chain costs; however, 8.33% respondents disagreed with this statement and approximately 17% remained neutral in this regard.

The findings from the study also reveal that 75% of the ACMs surveyed were of the opinion that innovation improved their delivery time, whereas approximately 17% of the ACMs surveyed did not believe that innovation led to an improvement in their delivery times. Approximately 74% of ACMs surveyed were of the view that they developed new products as a consequence of innovation: However, 6.52% of respondents did not believe that this was true, whereas approximately 20% of respondents remained neutral regarding the impact of innovation on the development of new products or services in their organisations.

4.22 Innovation Collaborations

The respondents were asked to identify the innovation collaborations in which their companies participated during the period 2013 to 2014. Table 4.4 below: reveals the responses of the respondents.

Table 4.4 Innovation Collaborations

(Local refers to Gauteng, and domestic refers to South Africa)

	Local	Domestic	International
	%	%	%
Other companies R & D – Developing new processes	21%	54.80%	23.80%
Acquisition of machinery and equipment	23%	22.70%	54.50%
Acquisition of innovation knowledge	25%	34.10%	40.90%
Training stakeholders on process innovation	44%	19.50%	36.60%

From 2013 to 2014, 54.50% of the ACMs surveyed indicated that they had imported machinery and equipment; 22.7% sourced their machinery and equipment from organisations within South Africa; and 23% of the ACMs surveyed sourced their machinery and equipment from suppliers based in Gauteng. Approximately 41% of respondents indicated that they acquired innovation knowledge by partnering with international organisations, while 34.10% acquired knowledge on innovation by collaborating with domestic organisations, and 25% acquired innovation knowledge by working together with other organisations based in Gauteng. More than a third (36.60%) of the respondents indicated that the training of stakeholders on process innovation was conducted by international organisations, whereas 19.50% of the stakeholders received training on process innovation from organisations based in South Africa, and 44% of the training on process innovation took place in Gauteng, or was conducted by organisations based in Gauteng.

Approximately 55% of the ACMs surveyed developed new processes in partnership with other domestic companies, while 23.80% developed new processes in partnership with international companies, and 21% of the ACMs surveyed developed new processes in partnership with other companies located in Gauteng.

4.23 Conclusion

The data collected from the questionnaires administered among ACMs in Gauteng was presented, analysed and discussed. A detailed picture emerged of the nature and extent to which these ACMs are innovative with regard to their processes, products and organisational culture. Based on the responses, it would seem that, overall, the majority of respondents are not only aware of the importance of being innovative in order to remain competitive, but have introduced measures to promote innovation in their organisations. The finding that 82% of the ACMs in Gauteng have been in business for over ten years also indicates that they are most probably successful, and see no need to expand their operations to produce the volume of components required by local motor vehicle manufacturers.

In the next chapter, *inter alia*, the major findings of the study are summarised, and recommendations are made on how ACMs in Gauteng can become more innovative.

CHAPTER FIVE

SUMMARY OF THE MAIN FINDINGS OF THE STUDY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter commences with a summary of the major findings from both the literature reviewed and the empirical study. Thereafter, some tentative conclusions and recommendations regarding the use of innovative strategies by automotive component manufacturers (in Gauteng) are presented. The chapter concludes by outlining the limitations of the study and by suggesting areas for future research.

5.2. Summary of the major findings from the study

From the literature reviewed for this study, the following findings regarding innovation and automotive component manufacturers emerged:

- organisations that are more innovative are more competitive than those that are less innovative;

- creativity alone, without innovation, is not effective, as it cannot improve the competitiveness of an organisation;

- those ACMs that successfully implement product and process innovations are more competitive than those who are less successful in implementing product and process innovations;

- employee input into innovation is influenced by an organisation's creative environment; the quality of communication within the organisation, as well as the quality of on-the-job training;

- innovation is most likely to occur in organisations that:
  - have integrative structures;
  - emphasize diversity;
  - have multiple structural linkages inside and outside the organisation;
  - have collective pride and faith in people's talents, and
  - emphasize collaboration and teamwork;

- with regard to employment, the automotive industry plays a very important role in South Africa, with 496 000 people employed in the industry in 2015;

- in 2015, the automotive industry in South Africa contributed 7.5% to GDP; accounted for 33.5% of South Africa's manufacturing output; and was responsible for 14.6% of South African exports;

- the government has identified the automotive industry as a key growth sector, with the aim of increasing vehicle production to 1.2 million units by 2020;

- poor productivity, coupled with relatively high wages and salaries, have contributed to South African ACMs failing to maintain a globally competitive position.

- the shortage of skilled workers negatively impacts on the performance of local automotive manufacturers in South Africa

- generally, labour disputes in South Africa take time to resolve, and this impacts negatively on the ability of ACMs to produce components at a competitive cost and to respond quickly and reliably to first-world market demands, and

- local ACMs have to contend with costs incurred due to delays at ports, as well as the high prices of materials and fuel, due to the deteriorating rand/dollar exchange rate.

From the empirical study undertaken, the following important findings regarding innovation amongst automotive component manufacturers in Gauteng emerged:

- the majority of automotive component manufacturers (51%) targeted their products to motor vehicle manufacturers; compared to those who targeted original equipment suppliers, and/or aftermarket wholesalers and retailers;

- seven out of every ten ACMs in Gauteng have been supplying automotive components for more than 15 years;

- the majority (88%) of Automotive Component Manufacturers in Gauteng were supplying component products for passenger cars, as opposed to commercial vehicles;

- with regard to the process innovation tools used, over half (56%) of the ACMs surveyed used Just-in-Time (JIT); 29% used quality control systems; 7% used continuous improvement; 3% used lean manufacturing; 3% used just in case; and 2% of the respondents used quality circles/team work;

- less than 50% (48.9%) of the ACMs surveyed had a Research and Development (R&D) department, while 43% of the ACMs in Gauteng had a Product Development department;

- an overwhelming majority (82%) of respondents agreed that their organisations had mechanisms in place for employees to contribute new ideas;

- the majority of respondents (74%) stated that new ideas and suggestions from employees have been implemented;

- the majority (87.2%) of the ACMs surveyed used product development tools on a systematic basis, while approximately 35% stated that they did not used advanced tools for product development;

- over three quarters of the ACMs surveyed (76%) stated that new product ideas were sourced by studying the needs of their customers, who were either motor vehicle manufacturers, original equipment suppliers, or the aftermarket;
- more than seven out of every ten ACMs in Gauteng sourced new product ideas by developing market exploration programmes and by regularly analysing market trends or by using their current products to anticipate the future needs of their customers;

- the majority (88%) of ACMs in Gauteng associate innovation primarily with product and process development;

- a sizeable proportion of the ACMS surveyed (30%) were not using any innovation tools and there were no procedures in place for introducing them;

- ACMs ranked their clients, who include motor vehicle manufacturers and original equipment suppliers, as the most important source of innovation; with existing employees ranked second; suppliers ranked third, and competitors ranked fourth;

- approximately 76% of the respondents stated that employees were trained on innovation on an on-going basis by both internal and external facilitators;

- during 2013-2014, 50% of the ACMs surveyed had introduced new or significantly improved manufacturing methods which were new to the firm; 27.1% introduced methods which were new to the domestic market; and approximately 23% introduced manufacturing methods which were new to the world;

- the majority of respondents (81.25%) agreed that innovation contributed to an increase in the quality of their products and services, and 75% of the respondents agreed that innovation resulted in the reduction of their manufacturing and supply chain costs, and

- 75% of the ACMs surveyed were of the opinion that innovation improved their delivery time.

5.3 Conclusion

The automotive industry, which includes both vehicle manufacturers and automotive component manufacturers, is one of the largest employers in South Africa. It also generates billions of rand in foreign exchange annually through the exportation of a large number of vehicles and automotive components. Therefore, it is very important that local automotive component manufacturers are able to compete successfully with foreign automotive component manufacturers, not only to supply local vehicle manufacturers but also to supply vehicle manufacturers, original equipment suppliers, as well as the aftermarkets located outside South Africa. Overall, the findings related to the use of innovative strategies by ACMs in Gauteng is encouraging, and it seems that other factors play a bigger role for local vehicle manufacturers not sourcing more of their automotive components from local ACMs. The fact that 70% of the ACMs in Gauteng have been in operation for 15 years and over implies that they are successful.

5.4 Recommendations

The following recommendations regarding the use of innovative strategies amongst automotive component manufacturers in Gauteng are proposed:

- ACMs in Gauteng should form partnerships with other domestic (South African) ACMs in terms of exchanging ideas regarding the most appropriate strategies to follow when entering foreign markets; especially those in developing countries;

- ACMs in Gauteng should improve their level of innovativeness by creating strategic alliances with both their suppliers and their customers, especially motor vehicle manufacturers;

- ACMs should use competitive benchmarking to identify the gap between industry and their own organisational standards regarding process and product innovation, so that they could close the gap;

- local ACMs should consider merging with other local ACMs producing similar automotive components. This will enable them to enjoy greater economies of scale, and also to produce the volumes of automotive components demanded by the local vehicle manufacturers, and

- local ACMs should consider entering into strategic alliances; partnerships, and/or licensing agreements with ACMs in abroad, especially with ACMs from other developing countries, e.g. India.

5.5 Limitations of the study

The questionnaire was self-administered, and, although respondents were not required to identify their organisations, the possibility of self-reporting bias exists, especially regarding the development of new manufacturing processes and products, which were new to the firm; new to the domestic market, and new to the world. Furthermore, the results from this study amongst ACMs in Gauteng cannot be generalised for ACMs across the country. In addition, the study did not differentiate between locally-owned and foreign-owned ACMs in Gauteng, and any differences in the use of innovative strategies between locally-owned and foreign-owned ACMs in Gauteng could not be established.

5.6 Recommendations for future research

Future studies of automotive industry in South Africa, more especially automotive component manufacturers, could investigate, *inter alia*, the factors influencing the growth and efficiency of automotive component manufacturers in South Africa; the impact of the state's Automotive Production and Development Programme (APDP) on the automotive industry in South Africa; the extent to which ACMs in South Africa are adopting automated machinery and production processes, and their impact on

productivity; and the impact of Government legislation on the competitiveness of ACMs in South Africa.

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APPENDIX A

LETTER OF CONSENT

Dear Respondent

THE USE OF INNOVATIVE STRATEGIES BY AUTOMOTIVE COMPONENT MANUFACTURERS IN GAUTENG.

I am currently conducting research for my Master of Science - Business Administration under the supervision of Dr. S Chetty at the Durban University of Technology. The aim of this study is to ascertain the nature and extent to which automotive component manufacturers in Gauteng use innovative strategies to enhance their competitive position within the global automotive industry.

Please note that this is an independent research study and participation is voluntary. Your responses will be treated as **strictly confidential** and the **anonymity** of companies and respondents is assured.

If any part of the questionnaire is not clear, or if you have any queries, please contact me, Mr. Xola Qhogwana on 0834842554/ 0794919753.

Once you have completed your questionnaire, please return it to me via e-mail to: qhogwana@webmail.co.za. It would be appreciated if you could return the completed questionnaire to me by no later than four weeks.

Should you require a copy of the major findings of this research, please state your name, e-mail address or telephone number in the box below.

I look forward to your response.
Yours sincerely
Mr. Xola Qhogwana

APPENDIX B

QUESTIONNAIRE

1. Please indicate to which of the following markets your products are targeted. Multiple selection permitted

- [ ] Original equipment manufacturers (OEMs)
- [ ] Original equipment suppliers (OESs)
- [ ] Automotive retail and aftermarket
- [ ] Other:

2. Please indicate number of years your company has been supplying each of these market.*required Tick one

- ○ 0-5 years
- ○ 5-10 years
- ○ 10-15 years
- ○ 15 years +

3. Please indicate to which segments in the automotive industry you supply your products.*Required Multiple selection permitted

- [ ] Passenger Cars
- [ ] Commercial Vehicles
- [ ] Medium Commercial Vehicles
- [ ] Heavy Trucks
- [ ] Buses and coaches
- [ ] Other:

4. What is the status of the equipment and machinery in your organisation international Tick one

- ○ Ahead, compared to other companies in the Industry
- ○ Behind, compared to other companies in the Industry
- ○ Average, compared to other companies in the Industry
- ○ Not known, compared to other companies in the Industry
- ○ Other:

5. Which of the following strategies are primarily used by your company to access each of the following markets?

	Quality	Cost	New Products	Strategic Partnership	All
Domestic / local markets	○	○	○	○	○
Developing countries	○	○	○	○	○
Industrialized countries	○	○	○	○	○

6. Does your company use the following quality specification standards? If other, please specify

- [ ] ISO
- [ ] Other:

7. Which of the following are used in your organisation?

- [ ] Quality Control systems
- [ ] Just in time
- [ ] Continuous Improvement
- [ ] Quality circles/Team work
- [ ] Lean Manufacturing
- [ ] Just in Case
- [ ] Other:

8. Does your company have a Research & Development (R&D) department?

- ○ Product Engineering
- ○ Product Development
- ○ Research and Development

9. Please indicate the extent to which you agree with the following statements: Crossing the appropriate column (SA : Strongly agree, A: Agree, N: Neutral, DA: Disagree, SD Strongly disagree)

	SA	A	N	DA	SD
The company has mechanism in place for employees to contribute new ideas.	○	○	○	○	○
New ideas and suggestions from employees have been implemented	○	○	○	○	○
Employees ideas and suggestions are rewarded	○	○	○	○	○
The lack of response and acknowledgement from management discourages employees from contributing new ideas.	○	○	○	○	○

10. Please indicate which of the following statements apply to you organisation: Tick one

- ○ There is no procedure in place for developing new products. There are no clearly defined stages or initial forecasts with regard to costs and deadlines.
- ○ There is a simple, sequential product development and monitoring process.
- ○ The development of new products is planned and monitored on an on-going basis (in terms of deadlines and costs).
- ○ The company implements a thorough product development process directed at minimising time to market costs and based on a clearly defined schedule including a series of stages, a budget and a set of objectives.

11. Please indicate which of the following statements applies to your organisation.

	Yes	No
The organisation does not use any advanced tools for product development	○	○
Occasionally, some departments within our organisation make use of the advanced tools	○	○
Tools are used on a systematic basis	○	○
The organisation has an active policy of renovating, developing its own tools and implementing best practices when using them.	○	○
Are product development tools such as (cad/cam/cae, Qfd, value engineering, virtual prototype, service provision map, etc) used on a large-scale and on an on-going basis?	○	○

	Yes	No
All of the above	○	○

12. To what extent do you agree with the following statements concerning the design of new products and new processes used? Crossing the appropriate column (SA: Strongly agree, A: Agree, N: Neutral, DA: Disagree, SD Strongly disagree)

	SA	A	N	DA	SD
Industrial design is regarded as a secondary element which does not deserve any special attention.	○	○	○	○	○
Design improvements are only incorporated in the later stages of the development process.	○	○	○	○	○
Design is occasionally introduced into the various stages of development of a product from a variety of different angles.	○	○	○	○	○
Industrial design and/or new technologies are used from the concept stage to improve the features of a product, simplify its components, ensure manufacturability or make it more attractive.	○	○	○	○	○

13. Please indicate the extent to which you agree with the following statements:

	SA	A	N	DA	SD
New products are created on the basis of intuition, without studying the customers' needs or competitors' activities.	○	○	○	○	○
The company relies both on its experience in the industry and its regular distributor and agent network to provide it with the market information it needs (customers' needs and competitors' actions) to create new products.	○	○	○	○	○
The company gets its products ideas by studying its customers' needs, involving other sectors in the company and systematic monitoring of both the activities and new products developed by its direct competitors.	○	○	○	○	○
The company analyses the use of its current products to be in a position to anticipate the future needs of its customers.	○	○	○	○	○
The company develops market exploration programmes and performs regular analyses of market trends.	○	○	○	○	○
The company studies its competitors' activities to gather new ideas for improvement	○	○	○	○	○

14. Please indicate the extent to which you agree with the following statements:

	SA	A	N	DA	SD
There are set methods for managing innovation	○	○	○	○	○
Innovation is associated with the development of products and processes.	○	○	○	○	○
Management allocates resources to innovation, mainly to technological, aspects	○	○	○	○	○
Management has a policy of systematically managing innovation a resources are allocated on an ongoing basis to advance innovation.	○	○	○	○	○

15. Please indicate the extent to which you agree with the following statements:

	SA	A	N	DA	SD
Management does communicate its innovation strategy when communicating to employees, customers, shareholders and suppliers.					
Management talks about innovation and clearly communicates what it means by it.					
Management communicates the idea of innovation to stakeholders but the communication processes does not work properly.					

16. Please indicate which one of the following statements apply to your organisation: Multiple selection permitted

- Innovation tools are not used and there is no procedure in place for introducing them.
- Occasionally, some advanced innovation tools are used to create new concepts.
- A number of advanced innovation tools are used on a regular basis to create and select new concepts.
- As a rule, great value is placed on the opportunity of introducing new tools whilst improving those already existing.

17. Rank from 1 (most important) to (5 least important) the sources of innovation and knowledge for new products / processes developed in 2013 / 2014.

	1	2	3	4	5
Existing employees					
Suppliers					
Clients					
Competitors					
Consultancy companies					
Universities					
Government					

18. Please indicate the extent to which you agree with the following statements: Crossing the appropriate column (SA: Strongly agree, A: Agree, N: Neutral, DA: Disagree, SD Strongly disagree)

	SA	A	N	DA	SD
No Training is offered to employees on innovation					
From time to time training on innovation is provided					
Management encourages in-house training only					
Employees are trained on an ongoing basis by internal and external facilitators					

19.1. PROCESS Innovation

	New to the World	New to the Domestic Market	New to the Firm
PR1. New or significantly improved methods of manufacturing			

	New to the World	New to the Domestic Market	New to the Firm
PR2. New or significantly improved logistics			

19.2 PRODUCT Innovation

	New to the World	New to the Domestic Market	New to the Firm
P1. New or significantly improved service			
P2. New or significantly improved products			

19.3 ORGANISATIONAL Innovation

	New to the World	New to the Domestic	New to the Firm
O1. New internal management practices			
O2. New methods of organising external relations			

20. Please indicate the impact of the innovations referred to in Q.19 on your organisation: Crossing the appropriate column (SA : Strongly agree, A: Agree, N: Neutral, DA: Disagree, SD Strongly disagree)

	SA	A	N	DA	SD
It contributed to increase the quality of our products or services					
It reduced the costs of manufacturing our products or supplying our services					
It helped improved our delivery time					
As a consequence we developed new products or services					

21. In 2013 - 2014, did your company engage in any of the activities below? Local (Gauteng), Domestic (National), International (All over the world)

	Local	Domestic	International
Within the Company‘s R & D – Developing new products			
Other companies R & D – Developing new process			
Acquisition of machinery and equipment			
Acquisition of other external knowledge			
Training stakeholders on process innovation			

22. Please indicate which of the following incentives have helped your organisation.

	From the local Government	From the National Government	International funding
SARS Tax incentives			
Private Investment to develop new products and acquire technology			
Automotive Investment Scheme (AIS)			
Manufacturing Competitiveness Enhancement Programme (MCEP)			

APPENDIX C:

PROOF OF EDITING AND PROOFREADING OF DISSERTATION

696 Clare Road

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4091

22 August 2016

CONFIRMATION

Editing of Masters Dissertation : Mr Xola Qhogwana
"The Use of Innovative Strategies by Automotive Component Manufacturers in Gauteng"

The above document has been language edited.

Regards

[redacted]

MP Mathews

Cell (0836764778)

APPENDIX D

MULTIVARIATE TESTS

Q20a	It contributed to increase the quality of our products or services
Q20b	It reduced the costs of manufacturing our products or supplying our services
Q20c	It helped improved our delivery time
Q20d	As a consequence we developed new products or services

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.974	75.940[b]	6.000	12.000	.000
	Wilks' Lambda	.026	75.940[b]	6.000	12.000	.000
	Hotelling's Trace	37.970	75.940[b]	6.000	12.000	.000
	Roy's Largest Root	37.970	75.940[b]	6.000	12.000	.000
Q20a	Pillai's Trace	.952	1.968	12.000	26.000	.072
	Wilks' Lambda	.144	3.267[b]	12.000	24.000	.007
	Hotelling's Trace	5.269	4.830	12.000	22.000	.001
	Roy's Largest Root	5.139	11.134[c]	6.000	13.000	.000
Q20b	Pillai's Trace	.942	1.068	18.000	42.000	.414
	Wilks' Lambda	.294	1.035	18.000	34.426	.450
	Hotelling's Trace	1.653	.979	18.000	32.000	.504
	Roy's Largest Root	1.041	2.429[c]	6.000	14.000	.080
Q20c	Pillai's Trace	1.222	3.406	12.000	26.000	.004
	Wilks' Lambda	.090	4.678[b]	12.000	24.000	.001
	Hotelling's Trace	6.669	6.114	12.000	22.000	.000
	Roy's Largest Root	6.099	13.214[c]	6.000	13.000	.000
Q20d	Pillai's Trace	.719	1.216	12.000	26.000	.324
	Wilks' Lambda	.403	1.152[b]	12.000	24.000	.368
	Hotelling's Trace	1.181	1.083	12.000	22.000	.419
	Roy's Largest Root	.808	1.750[c]	6.000	13.000	.187
Q20a * Q20b	Pillai's Trace	.477	1.827[b]	6.000	12.000	.176
	Wilks' Lambda	.523	1.827[b]	6.000	12.000	.176
	Hotelling's Trace	.913	1.827[b]	6.000	12.000	.176

	Roy's Largest Root	.913	1.827[b]	6.000	12.000	.176
Q20a * Q20c	Pillai's Trace	.170	.411[b]	6.000	12.000	.858
	Wilks' Lambda	.830	.411[b]	6.000	12.000	.858
	Hotelling's Trace	.206	.411[b]	6.000	12.000	.858
	Roy's Largest Root	.206	.411[b]	6.000	12.000	.858
Q20a * Q20d	Pillai's Trace	.462	1.717[b]	6.000	12.000	.200
	Wilks' Lambda	.538	1.717[b]	6.000	12.000	.200
	Hotelling's Trace	.858	1.717[b]	6.000	12.000	.200
	Roy's Largest Root	.858	1.717[b]	6.000	12.000	.200
Q20b * Q20c	Pillai's Trace	.580	2.758[b]	6.000	12.000	.064
	Wilks' Lambda	.420	2.758[b]	6.000	12.000	.064
	Hotelling's Trace	1.379	2.758[b]	6.000	12.000	.064
	Roy's Largest Root	1.379	2.758[b]	6.000	12.000	.064
Q20b * Q20d	Pillai's Trace	.327	.973[b]	6.000	12.000	.483
	Wilks' Lambda	.673	.973[b]	6.000	12.000	.483
	Hotelling's Trace	.487	.973[b]	6.000	12.000	.483
	Roy's Largest Root	.487	.973[b]	6.000	12.000	.483
Q20c * Q20d	Pillai's Trace	.862	1.641	12.000	26.000	.141
	Wilks' Lambda	.268	1.863[b]	12.000	24.000	.094
	Hotelling's Trace	2.245	2.058	12.000	22.000	.069
	Roy's Largest Root	2.003	4.339[c]	6.000	13.000	.013
Q20a * Q20b * Q20c	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	14.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	6.000	11.000	1.000
Q20a * Q20b * Q20d	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	14.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	6.000	11.000	1.000
Q20a * Q20c * Q20d	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	14.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	6.000	11.000	1.000
Q20b * Q20c * Q20d	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	14.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	6.000	11.000	1.000
Q20a * Q20b * Q20c * Q20d	Pillai's Trace	.000	.[b]	.000	.000	.
	Wilks' Lambda	1.000	.[b]	.000	14.500	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.
	Roy's Largest Root	.000	.000[b]	6.000	11.000	1.000

a. Design: Intercept + Q20a + Q20b + Q20c + Q20d + Q20a * Q20b + Q20a * Q20c + Q20a * Q20d + Q20b * Q20c + Q20b * Q20d + Q20c * Q20d + Q20a * Q20b * Q20c + Q20a * Q20b * Q20d + Q20a * Q20c * Q20d + Q20b * Q20c * Q20d + Q20a * Q20b * Q20c * Q20d
b. Exact statistic
c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F
Corrected Model	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	13.882[a]	21	.661	1.073
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	9.537[b]	21	.454	1.433
	2 PRODUCT Innovation [P1 New or significantly improved service]	7.584[c]	21	.361	.997
	2 PRODUCT Innovation [P2 New or significantly improved products]	12.088[d]	21	.576	1.421
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	10.287[e]	21	.490	1.796
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	11.667[f]	21	.556	3.148
Intercept	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	86.318	1	86.318	140.057

	1 PROCESS Innovation [PR2 New or significantly improved logistics]	96.208	1	96.208	303.643
	2 PRODUCT Innovation [P1 New or significantly improved service]	78.220	1	78.220	215.900
	2 PRODUCT Innovation [P2 New or significantly improved products]	75.001	1	75.001	185.151
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	83.623	1	83.623	306.616
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	98.564	1	98.564	558.527
Q20a	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.667	2	.334	.541
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.640	2	.320	1.010
	2 PRODUCT Innovation [P1 New or significantly improved service]	.043	2	.021	.059
	2 PRODUCT Innovation [P2 New or significantly improved products]	2.041	2	1.020	2.519
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.320	2	.160	.586

	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	2.785	2	1.392	7.889
Q20b	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	1.184	3	.395	.640
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	2.035	3	.678	2.141
	2 PRODUCT Innovation [P1 New or significantly improved service]	3.164	3	1.055	2.911
	2 PRODUCT Innovation [P2 New or significantly improved products]	1.047	3	.349	.862
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	2.774	3	.925	3.391
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.998	3	.333	1.885
Q20c	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	1.047	2	.523	.849
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	2.112	2	1.056	3.333
	2 PRODUCT Innovation [P1 New or significantly improved service]	.286	2	.143	.394

	2 PRODUCT Innovation [P2 New or significantly improved products]	2.782	2	1.391	3.434
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	1.803	2	.902	3.306
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	3.695	2	1.848	10.470
Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	1.527	2	.763	1.239
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.049	2	.025	.078
	2 PRODUCT Innovation [P1 New or significantly improved service]	.727	2	.364	1.004
	2 PRODUCT Innovation [P2 New or significantly improved products]	2.059	2	1.030	2.542
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	1.827	2	.913	3.349
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.761	2	.381	2.157
Q20a * Q20b	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.071	1	.071	.116

	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.071	1	.071	.225
	2 PRODUCT Innovation [P1 New or significantly improved service]	2.571	1	2.571	7.098
	2 PRODUCT Innovation [P2 New or significantly improved products]	.286	1	.286	.705
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.643	1	.643	2.357
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.071	1	.071	.405
Q20a * Q20c	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.523	1	.523	.848
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.222	1	.222	.702
	2 PRODUCT Innovation [P1 New or significantly improved service]	.395	1	.395	1.091
	2 PRODUCT Innovation [P2 New or significantly improved products]	.668	1	.668	1.649
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.831	1	.831	3.047

	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.120	1	.120	.678
Q20a * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.019	1	.019	.031
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.019	1	.019	.061
	2 PRODUCT Innovation [P1 New or significantly improved service]	2.327	1	2.327	6.423
	2 PRODUCT Innovation [P2 New or significantly improved products]	.173	1	.173	.427
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	1	.000	.000
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	1	.000	.000
Q20b * Q20c	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.352	1	.352	.571
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.179	1	.179	.566
	2 PRODUCT Innovation [P1 New or significantly improved service]	2.240	1	2.240	6.183

	2 PRODUCT Innovation [P2 New or significantly improved products]	1.092	1	1.092	2.695
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.671	1	.671	2.459
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.096	1	.096	.547
Q20b * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	1.114	1	1.114	1.807
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.023	1	.023	.072
	2 PRODUCT Innovation [P1 New or significantly improved service]	.205	1	.205	.565
	2 PRODUCT Innovation [P2 New or significantly improved products]	.205	1	.205	.505
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.091	1	.091	.333
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.091	1	.091	.515
Q20c * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	3.321	2	1.661	2.695

	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.091	2	.045	.143
	2 PRODUCT Innovation [P1 New or significantly improved service]	1.805	2	.902	2.491
	2 PRODUCT Innovation [P2 New or significantly improved products]	.245	2	.122	.302
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.643	2	.321	1.179
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.379	2	.190	1.074
Q20a * Q20b * Q20c	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.000	0	.	.
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.000	0	.	.
	2 PRODUCT Innovation [P1 New or significantly improved service]	.000	0	.	.
	2 PRODUCT Innovation [P2 New or significantly improved products]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	0	.	.
Q20a * Q20b * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.000	0	.	.
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.000	0	.	.
	2 PRODUCT Innovation [P1 New or significantly improved service]	.000	0	.	.
	2 PRODUCT Innovation [P2 New or significantly improved products]	.000	0	.	.

	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	0	.	.
Q20a * Q20c * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.000	0	.	.
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.000	0	.	.
	2 PRODUCT Innovation [P1 New or significantly improved service]	.000	0	.	.
	2 PRODUCT Innovation [P2 New or significantly improved products]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	0	.	.
Q20b * Q20c * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.000	0	.	.
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.000	0	.	.
	2 PRODUCT Innovation [P1 New or significantly improved service]	.000	0	.	.
	2 PRODUCT Innovation [P2 New or significantly improved products]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	0	.	.
Q20a * Q20b * Q20c * Q20d	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	.000	0	.	.
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	.000	0	.	.
	2 PRODUCT Innovation [P1 New or significantly improved service]	.000	0	.	.
	2 PRODUCT Innovation [P2 New or significantly improved products]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	.000	0	.	.
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	.000	0	.	.

Error	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	10.477	17	.616	
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	5.386	17	.317	
	2 PRODUCT Innovation [P1 New or significantly improved service]	6.159	17	.362	
	2 PRODUCT Innovation [P2 New or significantly improved products]	6.886	17	.405	
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	4.636	17	.273	
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	3.000	17	.176	
Total	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	214.000	39		
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	209.000	39		
	2 PRODUCT Innovation [P1 New or significantly improved service]	199.000	39		
	2 PRODUCT Innovation [P2 New or significantly improved products]	179.000	39		
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	209.000	39		
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	227.000	39		
Corrected Total	1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]	24.359	38		
	1 PROCESS Innovation [PR2 New or significantly improved logistics]	14.923	38		
	2 PRODUCT Innovation [P1 New or significantly improved service]	13.744	38		
	2 PRODUCT Innovation [P2 New or significantly improved products]	18.974	38		
	3 ORGANISATIONAL Innovation [O1 New internal management practices]	14.923	38		
	3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]	14.667	38		
a. R Squared = .570 (Adjusted R Squared = .039)					
b. R Squared = .639 (Adjusted R Squared = .193)					
c. R Squared = .552 (Adjusted R Squared = -.002)					
d. R Squared = .637 (Adjusted R Squared = .189)					

e. R Squared = .689 (Adjusted R Squared = .306)
f. R Squared = .795 (Adjusted R Squared = .543)

It contributed to increase the quality of our products or services * 3 ORGANISATIONAL Innovation [O2 New methods of organising external relations] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]			Total
		New to the World	New to the Domestic Market	New to the Firm	
It contributed to increase the quality of our products or services	Strongly Agree	2	**15**	**4**	21
	Agree	1	**3**	**13**	17
	Neutral	0	4	0	4
	Disagree	0	0	1	1
	Strongly Disagree	0	0	1	1
Total		3	22	19	44

APPENDIX E

CROSSTABULATIONS

It contributed to increase the quality of our products or services * 1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing] Cross tabulation					
Count					
		1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	3	8	10	21
	Agree	6	3	9	18
	Neutral	1	2	2	5
	Disagree	0	0	1	1
	Strongly Disagree	1	0	0	1
Total		11	13	22	46

It contributed to increase the quality of our products or services * 1 PROCESS Innovation [PR2 New or significantly improved logistics] Cross tabulation					
Count					
		1 PROCESS Innovation [PR2 New or significantly improved logistics]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	3	14	4	21
	Agree	1	7	10	18
	Neutral	1	3	1	5
	Disagree	0	0	1	1
Total		5	24	16	45

It contributed to increase the quality of our products or services * 2 PRODUCT Innovation [P1 New or significantly improved service] Crosstabulation

Count

		2 PRODUCT Innovation [P1 New or significantly improved service]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	3	12	6	21
	Agree	2	10	6	18
	Neutral	2	2	0	4
	Disagree	0	1	1	2
	Strongly Disagree	1	0	0	1
Total		8	25	13	46

It contributed to increase the quality of our products or services * 2 PRODUCT Innovation [P2 New or significantly improved products] Cross tabulation

Count

		2 PRODUCT Innovation [P2 New or significantly improved products]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	4	15	2	21
	Agree	6	4	7	17
	Neutral	1	3	1	5
	Disagree	0	1	1	2
	Strongly Disagree	0	0	1	1
Total		11	23	12	46

It contributed to increase the quality of our products or services * 3 ORGANISATIONAL Innovation [O1 New internal management practices] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O1 New internal management practices]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	2	13	6	21
	Agree	2	8	7	17
	Neutral	1	2	0	3
	Disagree	0	0	2	2
	Strongly Disagree	0	0	1	1
Total		5	23	16	44

It contributed to increase the quality of our products or services * 3 ORGANISATIONAL Innovation [O2 New methods of organising external relations] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It contributed to increase the quality of our products or services	Strongly Agree	2	15	4	21
	Agree	1	3	13	17
	Neutral	0	4	0	4
	Disagree	0	0	1	1
	Strongly Disagree	0	0	1	1
Total		3	22	19	44

It reduced the costs of manufacturing our products or supplying our services * 1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing] Cross tabulation

Count

		1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	3	6	11	20
	Agree	4	4	7	15
	Neutral	2	3	2	7
	Disagree	1	0	2	3
	Strongly Disagree	1	0	0	1
Total		11	13	22	46

It reduced the costs of manufacturing our products or supplying our services * 1 PROCESS Innovation [PR2 New or significantly improved logistics] Cross tabulation

Count

		1 PROCESS Innovation [PR2 New or significantly improved logistics]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	2	14	4	20
	Agree	1	5	9	15
	Neutral	1	5	1	7
	Disagree	1	0	2	3
Total		5	24	16	45

It reduced the costs of manufacturing our products or supplying our services * 2 PRODUCT Innovation [P1 New or significantly improved service] Cross tabulation

Count

		2 PRODUCT Innovation [P1 New or significantly improved service]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	1	14	5	20
	Agree	3	6	7	16
	Neutral	2	4	0	6
	Disagree	1	1	1	3
	Strongly Disagree	1	0	0	1
Total		8	25	13	46

It reduced the costs of manufacturing our products or supplying our services * 2 PRODUCT Innovation [P2 New or significantly improved products] Cross tabulation

Count

		2 PRODUCT Innovation [P2 New or significantly improved products]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	3	12	5	20
	Agree	5	6	4	15
	Neutral	2	4	1	7
	Disagree	1	1	1	3
	Strongly Disagree	0	0	1	1
Total		11	23	12	46

It reduced the costs of manufacturing our products or supplying our services * 3 ORGANISATIONAL Innovation [O1 New internal management practices] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O1 New internal management practices]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	2	13	5	20
	Agree	1	6	8	15
	Neutral	1	4	0	5
	Disagree	1	0	2	3
	Strongly Disagree	0	0	1	1
Total		5	23	16	44

It reduced the costs of manufacturing our products or supplying our services * 3 ORGANISATIONAL Innovation [O2 New methods of organising external relations] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It reduced the costs of manufacturing our products or supplying our services	Strongly Agree	1	12	7	20
	Agree	1	4	9	14
	Neutral	0	6	0	6
	Disagree	1	0	2	3
	Strongly Disagree	0	0	1	1
Total		3	22	19	44

It helped improved our delivery time * 1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing] Cross tabulation

Count

		1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	3	4	10	17
	Agree	5	6	8	19
	Neutral	2	3	2	7
	Disagree	0	0	1	1
	Strongly Disagree	1	0	1	2
Total		11	13	22	46

It helped improved our delivery time * 1 PROCESS Innovation [PR2 New or significantly improved logistics] Cross tabulation

Count

		1 PROCESS Innovation [PR2 New or significantly improved logistics]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	2	14	1	17
	Agree	3	6	10	19
	Neutral	0	4	3	7
	Disagree	0	0	1	1
	Strongly Disagree	0	0	1	1
Total		5	24	16	45

It helped improved our delivery time * 2 PRODUCT Innovation [P1 New or significantly improved service] Cross tabulation

Count

		2 PRODUCT Innovation [P1 New or significantly improved service]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	1	13	3	17
	Agree	6	5	8	19
	Neutral	0	5	1	6
	Disagree	0	2	0	2
	Strongly Disagree	1	0	1	2
Total		8	25	13	46

It helped improved our delivery time * 2 PRODUCT Innovation [P2 New or significantly improved products] Cross tabulation

Count

		2 PRODUCT Innovation [P2 New or significantly improved products]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	3	10	4	17
	Agree	6	7	5	18
	Neutral	2	4	1	7
	Disagree	0	2	0	2
	Strongly Disagree	0	0	2	2
Total		11	23	12	46

It helped improved our delivery time * 3 ORGANISATIONAL Innovation [O1 New internal management practices] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O1 New internal management practices]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	1	12	4	17
	Agree	3	6	8	17
	Neutral	1	5	0	6
	Disagree	0	0	2	2
	Strongly Disagree	0	0	2	2
Total		5	23	16	44

It helped improved our delivery time * 3 ORGANISATIONAL Innovation [O2 New methods of organising external relations] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]			
		New to the World	New to the Domestic Market	New to the Firm	Total
It helped improved our delivery time	Strongly Agree	1	10	6	17
	Agree	1	7	10	18
	Neutral	1	5	0	6
	Disagree	0	0	1	1
	Strongly Disagree	0	0	2	2
Total		3	22	19	44

As a consequence we developed new products or services * 1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing] Cross tabulation

Count

		1 PROCESS Innovation [PR1 New or significantly improved methods of manufacturing]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	4	5	13	22
	Agree	3	5	4	12
	Neutral	2	3	3	8
	Disagree	0	0	1	1
	Strongly Disagree	1	0	0	1
Total		10	13	21	44

As a consequence we developed new products or services * 1 PROCESS Innovation [PR2 New or significantly improved logistics] Cross tabulation

Count

		1 PROCESS Innovation [PR2 New or significantly improved logistics]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	2	14	6	22
	Agree	2	3	7	12
	Neutral	0	6	2	8
	Disagree	0	0	1	1
Total		4	23	16	43

As a consequence we developed new products or services * 2 PRODUCT Innovation [P1 New or significantly improved service] Cross tabulation

Count

		2 PRODUCT Innovation [P1 New or significantly improved service]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	2	14	6	22
	Agree	3	5	4	12
	Neutral	1	5	1	7
	Disagree	0	1	1	2
	Strongly Disagree	1	0	0	1
Total		7	25	12	44

As a consequence we developed new products or services * 2 PRODUCT Innovation [P2 New or significantly improved products] Cross tabulation

Count

		2 PRODUCT Innovation [P2 New or significantly improved products]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	5	13	4	22
	Agree	3	4	4	11
	Neutral	2	4	2	8
	Disagree	0	1	1	2
	Strongly Disagree	0	0	1	1
Total		10	22	12	44

As a consequence we developed new products or services * 3 ORGANISATIONAL Innovation [O1 New internal management practices] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O1 New internal management practices]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	3	13	6	22
	Agree	1	4	6	11
	Neutral	0	5	1	6
	Disagree	0	0	2	2
	Strongly Disagree	0	0	1	1
Total		4	22	16	42

As a consequence we developed new products or services * 3 ORGANISATIONAL Innovation [O2 New methods of organising external relations] Cross tabulation

Count

		3 ORGANISATIONAL Innovation [O2 New methods of organising external relations]			
		New to the World	New to the Domestic Market	New to the Firm	Total
As a consequence we developed new products or services	Strongly Agree	2	13	7	22
	Agree	1	3	7	11
	Neutral	0	5	2	7
	Disagree	0	0	1	1
	Strongly Disagree	0	0	1	1
Total		3	21	18	42

APPENDIX F

KMO AND BARTLETT'S TEST

Section	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity		
		Approx. Chi-Square	df	Sig.
9	.803	82.721	6	.000
12	.554	42.114	6	.000
13	.845	122.643	15	.000
14	.712	49.261	6	.000
15	.568	23.106	3	.000
17	.724	129.849	21	.000
18	.662	30.097	6	.000
20	.809	125.928	6	.000

All of the conditions are satisfied for factor analysis.

APPENDIX G

ROTATED COMPONENT MATRIX

Component Matrix[a]

Section 9	Component
	1
The company has mechanism in place for employees to contribute new ideas	.861
New ideas and suggestions from employees have been implemented	.874
Employees ideas and suggestions are rewarded	.864
Positive response and acknowledgement from management encourages employees from contributing new ideas	.734

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Matrix[a]

Section 12	Component
	1
Industrial design is regarded as a secondary element which does not deserve any special attention	.690
Design improvements are only incorporated in the later stages of the development process	.719
Design is occasionally introduced into the various stages of development of a product from a variety of different angles	.785
Industrial design are used from the concept stage to improve the features of a product, simplify its components, ensure manufacturability or make it more attractive	.728

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Matrix[a]

Section 13	Component 1
New products are created on the basis of intuition, without studying the customers' needs or competitors' activities	.245
The company relies both on its experience in the industry and its regular distributor and agent network to provide it with the market information it needs (customers' needs and competitors' actions) to create new products	.763
The company gets its products ideas by studying its customers' needs, involving other sectors in the company and systematic monitoring of both the activities and new products developed by its direct competitors	.823
The company analyses the use of its current products to be in a position to anticipate the future needs of its customers	.857
The company develops market exploration programmes and performs regular analyses of market trends	.902
The company studies its competitors' activities to gather new ideas for improvement	.760

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Matrix[a]

Section 14	Component 1
There are set methods for managing innovation	.762
Innovation is associated with the development of products and processes	.726
Management allocates resources to innovation, mainly to technological, aspects	.775
Management has a policy of systematically managing innovation and resources are allocated on an ongoing basis to advance innovation	.817

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Matrix[a]

Section 15	Component 1
Management does communicate its innovation strategy when communicating to employees, customers, shareholders and suppliers	.570
Management talks about innovation and clearly communicates what it means by it	.829
Management communicates the idea of innovation to stakeholders and the communication processes are effective	.863

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Rotated Component Matrix[a]

Section 17	Component	
	1	2
Existing employees	.706	.025
Suppliers	.815	.279
Clients	.810	-.054
Competitors	.662	.360
Consultancy companies	.558	.635
Universities	.116	.888
Government	.017	.941

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 3 iterations.

Component Matrix[a]

Section 18	Component
	1
From time to time training on innovation is provided	.835
Management encourages in-house training only	.288
Employees are trained on an ongoing basis by internal and external facilitators	.809

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

Component Matrix[a]

Section 20	Component
	1
It contributed to increase the quality of our products or services	.907
It reduced the costs of manufacturing our products or supplying our services	.842
It helped improved our delivery time	.919
As a consequence we developed new products or services	.895

Extraction Method: Principal Component Analysis.

a. 1 components extracted.