The relationship between Total Quality Management and Innovation in the South African Foundry/Steel Industry

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ABSTRACT

In today's global economic environment, companies have to deal with strong global competition, fast technological changes, and shortage of resources; therefore, they need to innovate to produce competitive products or services in order to survive. Total quality management strives to create a culture of 'doing it right the first time' by designing and building quality into each activity, rather than inspecting quality in the final products. Most organisations have therefore implemented TQM practices in order to produce quality products and enhance their competitiveness. Innovation and TQM are regarded as the key drivers of competitiveness in business. Therefore a study on the link between TQM and innovation is of paramount importance, and although a number such studies were done in Europe, North America and Asia, no evidence is there for studies in Africa. As such, this thesis sought to contribute to the understanding of the relationship between TQM dimensions of customer focus, leadership and people management with the product and process forms of innovation in the South African Foundry industry.

A quantitative research approach was used to collect data from the South African Foundry industry and a low response rate of 83 respondents obtained. The hierarchical multiple regression analysis was used to study the relationship, with firm size and period since initial certification with a quality management system as the control variables. The results revealed that customer focus, leadership and people management were all positively related to product innovation while only people management was positively related to process innovation. Though the R^2 values explained less than 10% of the relationship, the results were statistically significant and underlines the importance of TQM in both quality and innovation fields. Certification was found to be negatively associated with process innovation while firm size played no role in both product and process innovations.

Keywords: Total quality management, leadership, customer focus, people management, product innovation, process innovation.

DECLARATION

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

Mainford Toga

Signed at ………Johannesburg……………………………………………

On the ………12th…………………….. day of …………June……………… 2017

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CHAPTER ONE: INTRODUCTION

1.1 Introduction

This chapter gives background information and outlines the reasons why it is important to conduct this study on South African steel industries, in particular, the steel foundry industry. Owing to the effects of globalisation, boosting the competitiveness of the South African steel industry is imperative, considering the role that the industry plays in the economy of the country. Participation in the global economy is no longer a choice, but a necessity, as the competition for market share is now a worldwide phenomenon. Companies must create new products and enact or embrace new processes in order for them to meet the needs of customers. Thus, they must consider innovation as a way of corporate life (Prajogo & Sohal, 2001). They must also continually provide higher quality products than the competition does. Porter (1980) proposed that competitive advantage could only be achieved when an organisation creates superior value for its customers,

Total quality management (TQM) has been hailed in extant literature to positively influence innovation, and with both innovation and TQM being considered key drivers for competitiveness, this study focuses on exploring the TQM–Innovation relationship. The objective of the study is, therefore, to examine the nature of their relationship, if any. The TQM practices/constructs of leadership, customer focus, and people management will be explored against the two forms of innovation, namely product and process innovations. Although such studies have been done elsewhere in Europe and Australia, to the best knowledge of this author, there has not been any related study done in South Africa. In this study, TQM is taken in its general sense of a management philosophy that drives the production of quality products or the provision of quality service in an organisation (Demirbag, Tatoglu, Tekinkus & Zaim, 2006; Arumugam, Ooi & Fong, 2008).

1.2 Background and Context of the Study

The steel industry is facing one of its worst crises since the Great Recession, with most steelmakers in most countries facing massive retrenchments, closure or both. South Africa has not been spared either, with major steel producers instituting massive retrenchments and/or contemplating possible closure. Highveld (Pty) Ltd, a large steelmaking firm in South Africa, has closed down indefinitely at the time of writing this report, while Scaw Metals Group and ArcelorMittal (Pty) Ltd have closed some sections of their operations, resulting in massive job losses. These three companies are the major producers of steel in South Africa.

The main contributor to this turbulence in the steel industry is excess steel capacity, which was estimated to be sitting at about five hundred metric tonnes in 2014 (Stewart, Drake, Bell, & Wang, 2014). This excess capacity has been caused by the slowing down in the global economy that has reduced demand, coupled with increased production – mainly by China – in the last two decades. These authors reported that steelmaking output capacity had been focused on increasing from 2.16 billion tonnes in 2013 to 2.36 billion tonnes by 2017, the time when the planned plants and those under construction would come online (Stewart et al., 2014). Cutting down on steel production capacity by closing some plants, especially some unprofitable government-funded ones, is not an option for most countries for fear of massive job losses. For the privately owned steel plants to avoid going under, their only the option is to become more competitive.

Protectionist measures, through the imposition of tariffs to safeguard the viability of the local steel industry, will have limited success due to the WTO bound rate of 10 % and the existence of other trade agreements that are in place with EU and SADC states where preferential tariff rates are in place (Tralac, 2016). This leaves the local steel industry with no option but to pursue a competitiveness strategy to survive the global competition. Also, imposing tariffs on steel imports may trigger a negative chain reaction, as the affected countries might react with other punitive measures of their own that would affect international trade.

Global steel casting production in 2015 was 105 million metric tonnes, with China contributing more that 50 % (having around 26 000 foundries) while the other BRICS nations have less than half of those figures (Modern Casting, 2015).

The globalisation of economies has created profound and substantial changes in markets, consumers, competitors and technology (Adonisi, 2003), necessitating the need for a robust strategy to minimise its effects. It has broadened the marketplace and increased competition, with customers demanding higher-quality products at competitive costs. This is because customers have enormous access to information and suppliers, which empowers them to demand an ever-increasing array of product features, higher quality, better service, and favourable price/cost ratios (Jung, Chow & Wu, 2003). Life cycles of goods or services nowadays are also becoming shorter (Yusr, 2016), necessitating the need to innovate frequently to stay in business.

It is critical, therefore, for organisations to provide a suitable climate for innovation to take place. The need for a conducive environment was succinctly captured by Prajogo and Ahmed (2006) who wrote "… to achieve high innovation performance, organizations first need to develop the behavioural and cultural context and practices for innovation (i.e. stimulus), and only within such conducive environments is it possible for organizations to develop innovative capacity … so as to more effectively deliver innovation outcomes and performance" (p. 499). Therefore, any study to identify factors that stimulate innovative behaviour is of critical importance.

1.3 Theoretical Underpinning of the Study

The resource based-view (RBV) theory contends that organisations build superior performance and competitive advantage by developing and deploying unique and distinguished resources and capabilities (Yusr, Mokhtar & Othman, 2014). The RBV theory focuses on the organisation's resources and capabilities that are difficult to imitate as a source for competitive advantage. The implementation of TQM in an organisation can develop core competencies or capabilities that become the unique resources for the organisation (Tena, Llusar & Puig; 2001). Therefore, deploying TQM synergistically with innovation can create capabilities that differentiate an organisation and give it a competitive advantage in the global economy. By employing TQM practices, an organisation builds its capacity to produce quality and competitive products. Similarly, by strengthening its ability to create new products, processes and systems, an organisation develops its own innovation capability. Therefore, developing and enhancing these capabilities can help improve an organisation's performance and lead to building competitive advantage over its competitors.

1.4 The Role of TQM and Innovation in Competitiveness

Porter (1980) asserted that cost leadership and differentiation represent two fundamental approaches for achieving competitive advantage. The cost leadership strategy aims at achieving better returns than competitors do by providing low prices which can be achieved when production costs are low, while the differentiation strategy allows an organisation to offer unique products, which its competition cannot provide.

Fernandes and Lourenço (2011) suggested that the concepts of quality and innovation constitute the centre of strategic management in the business world today and have become the guiding elements for what is known as management excellence. These are elements that increase the competitive advantage of firms. TQM practices enhance competitive performance by improving the quality of products and processes. Innovation implies the creation or adoption of new products, services, and working processes. This fosters differentiation competitive advantage to a firm.

By pursuing TQM, an organisation will improve the quality of its products and reduce rejects and reworks, which will indirectly reduce production costs, leading it to achieve a cost leadership strategy (Prajogo, 2007). Pursuing TQM demands that firms control the production processes to minimise defects in their outputs, and also reduce failure costs. Therefore, the successful implementation of a quality management system yields a number of benefits, such as low production costs and higher productivity attributable to the reduction of rejects and reworks. Other benefits are the production of higher quality products, the consequent ability to charge higher prices, and customer satisfaction leading to customer loyalty and repeat business.

On the other hand, a differentiation strategy entails that an organisation should build competitive advantage by offering products that are uniquely distinguished from those of the competition. Differentiation can be attributable to different features that the product possesses, how it is delivered to customers, or a broad range of other factors (Prajogo, 2007).

The strategy of differentiation is to provide better products or services than competitors do in meeting the needs of customers who view the products or services as unique and different from any other offerings which serve the same purpose in the market (Porter, 1980). Innovation is the basis through which an organisation achieves a differentiation strategy.

In this study, the two dynamic outcomes of innovation, namely product innovation – changes in the specific products/services offered to the customers and process innovation – and changes in the mode by which the products are created or delivered, will be considered.

With product innovation, a firm can strategically differentiate its products offering in the marketplace, thereby satisfying market demands, building customer loyalty, and improving its overall performance (Damanpour & Gopalakrishnan; 2001; Damanpour, 2010). Process innovation is concerned with the renewal of means of production within an organisation and it drives a firm's performance by improving productivity and/or lowering production costs. This means that process innovation can also be used to pursue a cost leadership strategy, if an organisation manages to implement processes that produce products more cheaply and efficiently than the competition does.

Over the years, TQM has been a source of competitive advantage and most manufacturing companies have pursued this strategy since the 1980s when it became clear that Japanese companies were outperforming the rest of the world on quality. According to Miller (1996), Japanese firms had embarked upon the philosophy of total quality management, using the core ideas put forward by the pioneering quality experts such as Juran, Crosby, Deming and Ishakawa (Miller, 1996; Hassan, Shaukat & Nawaz, 2013). It is widely acknowledged that the modern-day approach to quality improvements has its roots in Japan, from which their firms have drawn strong competitive advantage, especially in the automotive industry (Cole & Matsumiya, 2008). South African companies, and those the world over, vigorously pursue a structured version of a quality management system under the auspices of International Standards Organisation to enhance their competitive advantage through quality improvements. Thus, most companies have implemented the ISO 9001 quality management systems, a part of a never-ending journey towards achieving Total Quality Management, in pursuit of competitive advantage. Manders, de Vries and Blind (2016) have reported that, according to an ISO survey done in 2013, the ISO system had been implemented by over one million organisations in 187 countries.

However, in the modern global landscape, TQM is no longer regarded as a source of competitive advantage, but merely represents "… qualifying criteria with flexibility, responsiveness and particularly innovation taking over as winning order criteria" (Prajogo & Sohal, 2001; 2003). Supporting this viewpoint, Hoang, Igel and Laosirihongthong (2006 p.1093) reported that "… the basis of sustainable competitive advantage has shifted from quality to innovation as a fundamental component of entrepreneurship". Kim, Kumar and Kumar (2012) also noted that nowadays, organisations need to be innovative to seize new opportunities and protect knowledge assets. Rääf (2016) proclaimed that companies compete on four interrelated but different fronts: efficiency, quality, flexibility and innovation.

Innovation has been hailed as a key driver of economic growth, a typical example being the 'Asian Tigers'(i.e. Singapore, Taiwan, South Korea and Hong Kong). In South Africa, there is an understanding that economic success is closely associated with innovation and technology systems (Lorentzen, 2009). It is therefore imperative to establish whether, and how, the elements of TQM are related to innovation, as these two variables are important for the competitiveness of organisations. Innovation is regarded as comprising the organisational ability and the process for transforming ideas into new products, processes, and systems, thus enhancing the growth of the organisation (Lawson & Samson, 2001; Yusr, 2016).

Examining the TQM–Innovation relationship is important for establishing whether TQM hinders or supports innovation. If it hinders innovation, an organisation can take actions to limit the impact and achieve both high quality and innovation performance. On the other hand, if it acts as an antecedent to innovation, then it is important to establish under what conditions it does so, so that the organisation can ensure that those conditions persist at all times (Manders et al., 2016).

1.5 The Problem Statement

Empirical studies done in North America, Europe, Asia on the relationship yielded conflicting findings (Bon, Mustafa & Rakiman, 2012; Fotopoulos & Psomas, 2009; Hoang, Igel & Laosirihongthong, 2010; Hung, Lien, Yang, Wu & Kuo, 2011; Lee, Ooi, Tan & Chong, 2010; Prajogo & Sohal, 2003, 2004a; Ratnasingam, Yoon, & Ioraş, 2013; Singh & Smith, 2004; Hoang et al., 2006). Most of these studies were done, spanning across industries. There are a few exceptions, for example, Abrunhosa and Sa (2008) conducted a study on the Portuguese footwear industry and found that the TQM principles had a positive association with the adoption of technological innovation. Industries may be at different stages of maturity and face different challenges that drive them toward different strategic paths.

Despite the large body of literature, no study could be found pertaining to the Southern Africa context, or to the steel industry in any part of the world. In addition, most studies have surveyed senior management at firms, the opinions of which may be positively biased with regard to the adoption of the total quality management principles at their firm. Since TQM involves everyone in an organisation, a more representative assessment of the adoption of the TQM principles would be obtained by surveying a broad spectrum of employees in an organisation. Therefore, it is of value to gain an understanding of this relationship with regard to the South African steel industry, and so gain profound insights that might help the industry to move out of the current difficult conundrum.

The majority of the studies were done across different industries, which in some cases do not face similar conditions and challenges. Additionally, some researchers have ignored the multidimensionality nature of innovation, and therefore their results lacked clarity in the dimensions considered in their research work (Abrunhosa & Sa, 2008).

The central premise of this study is that many organisations in South Africa have implemented TQM practices to boost their competitiveness, but today they need to innovate more than ever before. In resource-constrained environments, the pursuit of both quality and innovation might be challenging, and a study of the relationship could help managers to prioritise their efforts. It would be crucial for firms to leverage TQM practices in pursuit of innovation performance, if a positive relationship could be confirmed. This study will also extend the scope of enquiry to include surveying employees at supervisor and shop-floor levels, rather than only senior managers, which is something not done by previous researchers.

Based on the positivism paradigm research, this work attempts to gain a better understanding of the relationship between TQM and innovation, and so close the knowledge gap with respect to a specific sector, in addition to providing a practical answer to the crisis in the steel industry. Therefore, the preceding discussion enables the following research question and sub-question to be set out.

1.5.1 *Research Question*

Can TQM practices create a conducive environment that will enable steel firms to innovate much better, thereby creating sustainable competitive advantage over their competitors? Does TQM help in enhancing the innovation performance of enterprises in the steel industry?

1.5.2 Research Sub-Question

To what extent do the TQM practices of leadership, customer focus and people management influence the degree of product or process innovations?

1.6 Significance of the Study

Innovation is a critical tool for corporate entrepreneurship which enables organisations to exploit change for a different business or a different service. To date, no literature could be found concerning studies on the influence of the TQM practices of innovation in South Africa, particularly in the foundry industry. This points to the fact that there is a gap in knowledge on the African context, and this study aims to fill that gap. Studies done in the developed world were not sector specific, and they gave inconsistent findings, with some researchers arguing that a strong positive correlation between TQM and innovation exists (Martínez-Costa & Martínez-Lorente, 2008; Prajogo & Hong, 2008; Prajogo & Sohal, 2006), while others found no relationship (Bon & Mustafa, 2013; Singh & Smith, 2004). These divergent findings imply that a knowledge gap remains that warrants further study on the TQM–innovation relationship. Managers need to know if TQM practices can act as antecedents to innovation (Manders et al., 2016) so that they can enhance both quality and innovation benefits by promoting the implementation of TQM.

The study of the TQM–innovation relationship is also critical to the South African firms that are struggling to survive in the global economy. By innovating, they can create new product lines and/or develop new production methods that will enable them to compete successfully. If a positive relationship of TQM practices with innovation is established, then South Africa firms will have an idea of what to concentrate on to help them develop to a global status.

1.7 Delimitations of the Study

The scope of the TQM dimensions investigated in this research work was limited to only three dimensions of TQM, namely leadership, customer focus, and people management, so as to enable the study to be completed within the given timeframe. Innovations were also limited to two of its variables, i.e. product innovation and process innovation. Although the steel sector is quite large, the study is focused on the foundry sector only. This is because it is the only sector in the industry which gave this researcher access to its database of members to allow the identification of which member is certified to which quality management system. Other organisations, such as the Steel and Engineering Industries Federation of Southern **Africa** (SEIFA), reported that their database is confidential.

1.8 Definitions

This section gives the definitions of the terms as they are used in this study. The most appropriate of the existing definitions were chosen from literature and used in this study, and are as follows:

- Total quality management is defined as "a constant endeavour to fulfil and preferably exceed, customer needs and expectations at the lowest cost, by continuous improvement work, to which all involved are committed, focusing on the processes in the organisation" (Isaksson, 2006 p.633).
- Product innovations are defined as new products or services introduced to meet the external user need (Damanpour, 2010, p.997).
- Process innovation is defined as comprising new elements introduced into a firm's production or service operation to produce a product or render a service (Damanpour, 2010, p.997).

1.9 Assumptions

In this study, it is assumed that the term 'total quality management' (TQM) refers to all the quality management systems that different organisations have employed to boost their quality performance. It is used in the generic sense to represent many systems. These systems include the Malcolm Baldrige National Quality Award (MBNQA), the European Foundation for Quality Management, ISO 9001 Quality Management. Some of the organisations in South Africa are subsidiary to international organisations and would have implemented the quality management systems of their parent organisations.

1.10 Conclusion

If TQM is no longer the leading contender contributing to competitiveness, it calls for a reassessment of the focus on implementing TQM in organisations so that it remains relevant in determining the competitiveness of organisations, in addition to promoting quality excellence. The understanding of the relationship of TQM with innovation could shape the implementation their strategies by organisations. Extant literature has shown that there is no consensus on the impact of TQM on innovation, and with no studies having been done in South Africa, a plausible reason was found to explore the relationship between TQM and innovation in one of the struggling industries at the moment. Innovations can provide an antidote to the ailing South African steel industry.

CHAPTER TWO: LITERATURE EVALUATION

2.1. Introduction

This section discusses the roles of TQM and innovation in organisational management, as they are important in determining the competitive advantage of an organisation. This is because nowadays, companies have to deal with strong global competition, fast technological changes and a shortage of resources, and therefore need to innovate more and produce higher-quality products in order to be competitive and survive. This literature review looks at the main dimensions that constitute TQM, with more emphasis being placed on leadership, customer focus and people management, as these are the independent variables for this study. The preceding section discussed innovation constructs, with a strong emphasis on process and product innovations as the dependent variables. Finally, the relationship between TQM practices and innovations is analysed, from the perspectives of both conceptual and empirical studies. This is because innovation and TQM are strategic management tools needed in a turbulent and rapidly changing economic environment.

2.2. Defining Total Quality Management

The TQM literature concurs that the core ideas defining it have emanated from the work of quality experts such as Dr. W. Edward Deming, Mr.B. Philip Crosby, Dr. Kauro Ishikawa and Dr. M. Joseph Juran, although it is reported that they rarely used this term themselves (Hackman & Wageman, 1995; Martínez-Lorente, Dewhurst and Dale, 1998). According to Fonseca (2015), Fiegebbaum (1983) was the first to use the term ‘total quality management’. The term became widely used in the late 1980s when quality started to dominate business management practices (Martínez-Lorente et al., 1998) as it became apparent that Japanese firms were producing quality products, superior to those produced by firms in the rest of the world, and were therefore gaining in a share of the global market. However, there is no unified definition of TQM (Prajogo & Sohal, 2001).

According to ISO 9000: 2000, Total quality management is defined as “a management approach that tries to achieve and sustain long-term organisational success by encouraging employee feedback and participation, satisfying customer needs and expectations, respecting societal values and beliefs, and obeying governmental statutes and regulations”. Its aim is to create an environment in which ‘doing it right the first time’ is the goal, insisting on designing and building quality into each activity rather than inspecting it in the final product (Liao, Chang & Wu, 2010). The benefits of TQM implementation are the production of higher-quality products at reduced costs, having more satisfied employees and customers as a result of meeting their needs and expectations, and improved financial performance of the organisation. Embodied in total quality management are concepts such as quality control, quality assurance, quality improvement, and quality planning. These terms are defined below, according to ISO 9000: 2000 version:

- “Quality control is defined as a set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problems are solved”.
- “Quality assurance is defined as a set of activities whose purpose is to demonstrate that an entity meets all quality requirements. Quality assurance activities are carried out to inspire the confidence of both customers and management, the confidence that all quality requirements are being met”.
- “Quality improvement refers to anything that enhances an organisation’s ability to meet quality requirements”.
- “Quality planning is defined as a set of activities whose purpose is to define quality system policies, objectives, and requirements, and to explain how these objectives will be achieved, and how these requirements will be met. It is always future oriented”.

The main dimensions or principles that constitute TQM today are derived mainly from the works of Saraph, Benson, and Schroeder (1989), Flynn, Schroeder, and Sakakibara (1994), Ahire, Golhar, and Waller (1996), and Black and Porter (1996). Basing their deductions on the teachings of the quality gurus, they formulated and tested the constructs that represent total quality management. Most researchers today evaluate TQM through the six constructs that were common in their deductions, namely leadership, strategic planning, customer focus, information and analysis, people management, and process management. Some researchers consider customer focus, continuous improvement, employee involvement and top management support as the most important practices of TQM (Prajogo & Sohal, 2003; Llach, Casadesus and Marimon, 2011). Because of the time constraints within which to complete this study, the current work focuses on three dimensions, which are customer focus, leadership, and people management. These are the independent variables representing TQM in this research work. Accordingly, the subsequent sections discuss these constructs as they relate to total quality management and to their link with innovation, particularly process and product innovation.

2.3. The TQM Models

The concept of TQM represents a philosophy and a set of guiding principles that enable organisations to continuously improve on their quality products, processes or services. There is no unique method of TQM implementation and it is different from country to country, and organisation to organisation. However, there are various models which organisations can follow to increase the probability of successful implementation. These include the approaches described in Deming Application Price, Malcolm Baldrige Criteria for Performance Excellence, European Foundation for Quality Management, and ISO quality management standards. Applying any of these can enhance an organisation’s quality system and lead to total quality management. The most common model applied by organisations in South Africa is the ISO quality management system.

2.3.1 ISO 9000 Standards

Williams (1997) has argued that ISO 9000 certification provides the building blocks for successful and effective TQM implementation. The ISO 9000 Quality Management System was developed by the International Organisation for Standards (ISO) with the aim of promoting the understanding of quality management system requirements in national and international trade. By adopting these standards, companies can be assured that their quality programmes are built on a firm foundation (Pekovic & Galia, 2009). The standards guide the companies in the implementation of quality management systems. The proper implementation process is often ascertained through a voluntary certification process administered by accredited national public or private bodies. The South African Bureau of Standards is one such accredited certifying body in South Africa. The standards have been revised a number of times since their inception in 1987, with the latest revision being ISO 9000:2015.

The ISO 9000 standards are founded on eight fundamental principles, namely leadership, customer focus, systems approach to management, continuous improvement, involvement of people, process management, factual approach to decision-making, and mutually beneficial supplier relationships. These principles define the implementation of the quality system, and in this study, the implementation of an ISO 9000 Quality Management System is taken as an indicator of, or a precursor to, TQM in an organisation. This is because most companies have implemented the system in their TQM journey. The standards focus on the defining, establishing and maintaining of an effective quality assurance system for an organisation that implement these standards. According to an ISO survey (2013), ISO 9001 has been implemented by over one million organisations in 187 countries worldwide (Manders et al., 2016).

In order to appreciate the relation between Total quality management and ISO 9000 standards, the following representation (Figure 2.1 below), adapted from the works of Dale (2003) by Llach et al., (2011) is useful. Total quality management encompasses all quality management systems, with the ultimate goal of continuous improvement and production of quality products. The figure shows the various levels of a quality management system that are possible for an organisation, with TQM being the ultimate goal. It is important to mention that ISO 9000 is part of a family of standards that describe quality management systems and these include ISO 9001, 9002, 9003, and 9004. Companies are certified according to ISO 9001, as it is the document that contains the requirements of a quality management system. ISO 9004 links the benefits of ISO 9001 to an organisation's stakeholder. By implementing the ISO 9001 quality management system, the organisation would have demonstrated a good quality inspection and quality control system, and a quality assurance system, and would move towards TQM as it empowers its people and it continuously improves its processes, achieving the goal of 'doing it right the first time'. This ensures that an organisation provides its customers with quality products or services.

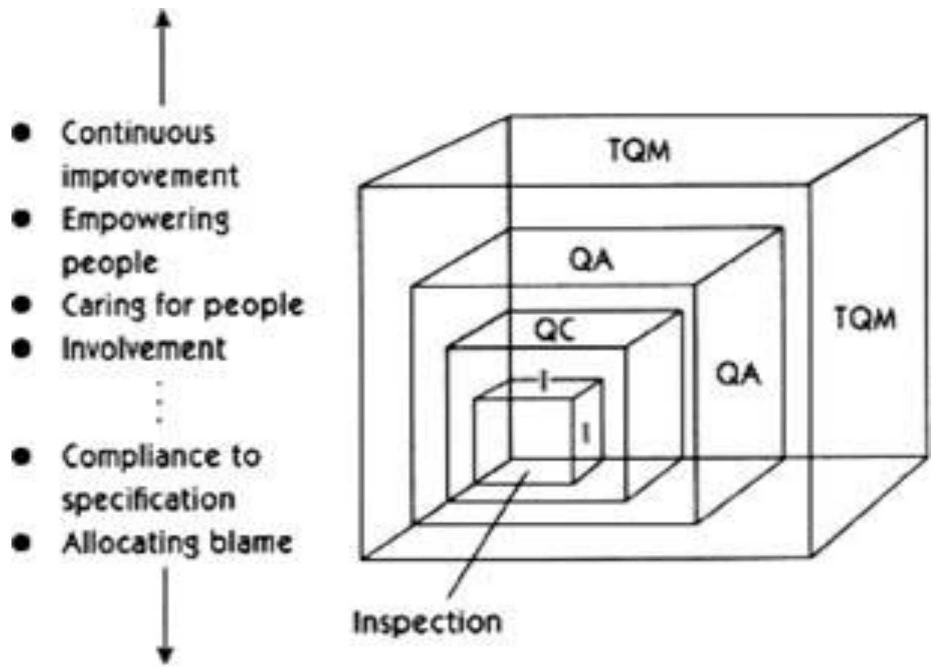

Figure 2.1: Progress towards TQM

Adapted from Llach, Casadesus & Marimon (2011, p. 54).

The four levels of quality management are identified as:

1. I – representing quality inspection. This level focuses on measurement, testing, and gauging to ensure product conformity with specifications. It provides information about end results.
2. QC – representing quality control. This involves the application of statistical process control (SPC) so as to detect and fix problems.
3. QA – representing quality assurance. Quality assurance is a management system that emphasises on product, service and process design to enhance the prevention of defects, thereby improving quality and productivity. By implementing ISO 9000 standards, organisations achieve this level of a quality management system (Llach et al., 2011).
4. TQM – referring to Total Quality Management. This refers to applying the quality management principles to all aspects of the organisation, including customers and suppliers, often integrating them with the major business processes (Dale, 2003). It is the ultimate goal in pursuit of quality.

As a quality assurance system, the ISO 9000 standards help companies to better organise and synchronise their operations by documenting their processes and defining duties and responsibilities among employees and departments. It is a well-structured tool with which to start implementing a quality system (Gotzamani & Tsiotras, 2001; Prajogo, 2011; Martínez-Costa & Martínez-Lorente, 2008). It shifts an organisation's attention from the quality of final products to the methods used to produce the products. Gotzamani and Tsiotras (2001) noted that there are differing views regarding its effectiveness and long-term contribution to the companies implementing it. The optimistic view proposes that by implementing the standards, a company benefits by improving the organisation's operations, ensuring coherent and effective communication, improving employees' knowledge on quality issues, lowering quality-related costs, and increasing customers' satisfaction and trust.

Others have claimed that the downside of implementing the standards is that firms may simply acquire certification to boost their quality status in the eyes of customers, but have limited commitment to quality. Other researchers have argued that some organisations obtain certification for external reasons, such as pressure from customers, the market or government regulations (Manders et al., 2016). Feng, Prajogo, Tan and Sohal (2006) reported that in Australia, the government's policies once demanded that all suppliers to government and the state be ISO 9000 certified, but this did not translate into improved quality and business performance. Thus, why and how the standards are adopted and implemented is crucial in determining their long-term effectiveness. The actual motive behind certification often dictates the extent to which the standards are implemented and are effective for the benefit of the organisation.

2.4. Conceptualisation of TQM

The primary function of TQM deployment is to foster business performance through the improvement and maintenance of quality within an organisation. It seeks to establish in an organisation, a culture of doing things right the first time by building quality into each activity so that the products will be of superior quality. Extant literature shows that organisations that have successfully implemented TQM have enjoyed superior business performance and/or competitive advantage over their counterparts (Arumugam, Ooi & Fong, 2008).

Hackman and Wageman (1995) have argued that the effectiveness of TQM is rooted in four interlocked assumptions about quality, people, organisations and the role of senior management. On quality, they argued that providing poor quality is more expensive than enacting processes that produce high-quality products which translate into high organisational performance. They also proposed that people have a natural inclination to produce quality work, provided that they receive the necessary tools and training. Their third assumption was that cross-functional teams are important in solving problems that transcend traditional functional lines. Finally, they argued that the role of management is critical because management creates organisational systems of production and provides the resources needed. Therefore, successful TQM is dependent on these variables, and organisations should implement TQM in order to produce higher-quality products, as well achieving as other benefits such as lowering overall production costs, better meeting the needs of customers and employees, and ultimately improving the financial performance of the organisation (Chang, Liao, Tay & Wu, 2008).

2.4.1. Leadership in TQM context

In the extant literature concerning TQM, the term ‘leadership’ is considered to encompass top management support and is focused on the leadership style (practice) rather than on the traits of leaders. Therefore, the terms ‘leadership’ and ‘top management support’ will be used interchangeably. Leadership in the TQM context reflects management’s orientation towards fostering quality within the organisation. It also entails participation by every employee in decision-making on issues that pertain to quality; they are given authority to make decisions (Puffer & McCarthy, 1996) for example, to stop production if defects are detected. It is described as the capacity to stimulate confidence and garner support from followers to accomplish organisational targets (Manders et al., 2016; Zhang, 2000).

Leadership plays a major role in TQM implementation, as the smooth implementation of the other TQM practices depend on the successful implementation of the leadership construct (Ahire et al., 1996; Kim et al., 2012; Manders et al., 2016; Zhang, 2000). High-quality performance is dependent on the commitment of top management (Zhang, Waszink & Wijngaard, 2000). Ulle and Kumar (2014, p. 154) noted Juran’s argument about the role played by management in quality where he had reported that “at least 85 percent of failures in organisations are the fault of systems controlled by management”. González and Guillen (2002) asserted that leadership “is an enabler of complete, deep and sustainable implementation of TQM principles: ‘complete’, because leadership facilitates the implementation of all the principles; ‘deep’ in the sense that the changes obtained through leadership go beyond new organisational arrangements and arrive at the field of personal values and behaviours; and ‘sustainable’ because, followers’ commitment to quality could hardly remain without the kind of trust that leadership generates” (p. 150).

Its task is to formulate a vision on quality for the organisation, to create goals, values and systems, thereby satisfying customers’ expectations, and so lead the organisation to successful performance. Clear quality goals are essential for the effectiveness of the organisation in its quality endeavours. Participation in quality-related meetings, the provision of resources to train employees and enable them to perform their duties properly, and delegating the decision-making authority to lower levels in the organisation are some of the ways in which leaders ensure their support for quality initiatives. Manders et al. (2016) viewed the roles of leadership to include determining quality goals, allocating resources needed to achieve those goals, facilitating learning in problem-solving techniques, and promoting continual improvement.

The role on top management in TQM has been succinctly discussed by Zhang (2000). He noted that the commitment of top management is crucial for everyone in the organisation to view quality as a primary goal. They should lead and participate in quality-related projects and demonstrate their commitment through actions rather than words. To act as role models, they need to learn the TQM concepts and be at the forefront in their implementation and should provide adequate resources for employee education and training. Finally, they should empower and encourage employees to unleash, develop and utilise their skills and knowledge, and to give suggestions on quality improvement (Zhang et al., 2000).

Ooi (2009) reported that leadership in the TQM context is “not much about power, authority and control, but more of empowerment, recognition, giving guidance and developing others” (p. 635). The TQM principles, according to ISO 9001 (2015), recommend that leaders delegate the decision-making authority to the lower levels within the organisations to empower employees to solve the problems they encounter (Zhang, 2000).

The successful implementation of the leadership principle with respect to TQM creates an environment that encourages working as one team, building a trust culture, and the flow and share of information among employees enabling them to learn, change and quickly respond to the changing world (Yusr, Mokhtar & Othman, 2014). Yusr et al. (2014) claimed that when the leadership is committed towards quality, the organisation builds a distinctive capability that makes it adapt easily to a changing environment.

2.4.2. Customer focus in the TQM context

Mahatma Gandhi is reputed to have said that customers are the reason for a firm's existence. This statement underscores the importance of customer focus to any organisation, and it is considered as being one of the key building blocks of TQM (Zhang, 2000). It helps an organisation to understand the environment it operates in by identifying unmet needs and thereby helps it align its strategy and technological capabilities (Manders et al., 2016). It helps an organisation to develop products or services needed by customers. Organisations that do not value customer focus often struggle to survive.

Customer focus is conceptualised as being the extent to which an organisation unceasingly uncovers customer needs and expectations. It entails that an organisation undertakes to determine the unmet needs of customers before aligning its production processes to produce products and services that fulfil those needs, thereby ensuring customer satisfaction. By maintaining a close relationship with customers, organisations can clearly establish the customers' needs, as well as assess the extent of their fulfilment (Ahire et al., 1996; Zhang, 2000). A firm's success is dependent on creating value for which a customer would willingly exchange his or her cash. Therefore, customer needs should be effectively and efficiently determined on a regular basis.

In the main, customer focus incorporates the gathering of information about customers, which is then distributed effectively within the firm itself so that the firm's activities are aligned to creating value for the customer. Such information is helpful in developing new products, making improvements to the existing ones, and solving any problems that the customers might be encountering with the current products. The customer needs, which are often defined on order placement, are the vital reason why a customer would purchase a product, while the wants or expectations are the implied needs that must also be met to ensure a satisfied customer. For example, people buy coffee to satisfy their thirst, but they expect to be served with hot coffee, and by a polite and courteous waiter or waitress. Therefore, needs and wants embody what the customer values as important in making a buying decision. By communicating the needs and wants of customers to its employees, an organisation ensures that the employees use their competencies and the organisation's resources to satisfy their customers.

According to ISO 9000, customer focus also encompasses determining customer complaints or levels of satisfaction, whether verbal, written or implied. Customer satisfaction is defined as "the customer's perception of the degree to which the customer's stated or implied needs or expectations are fulfilled" (Hoyle, 2003, p.45). Customers express their satisfaction through compliments, repeat orders, and referrals of non-customers. Customer complaints are adverse reports about the organisation's products or services, and these have to be captured, classified and investigated, and remedial actions taken. Customer complaints are often triggers for incremental improvements or innovations. Therefore, an organisation should treat customer complaints and customer satisfaction surveys with top priority, and if needed, corrective actions should be taken immediately to ensure that the organisation always serves satisfied customers, all the time (Zhang et al., 2000).

Therefore, information about the customers' needs is valuable intellectual capital. Ooi (2009) claimed that for an organisation to be successful, every decision it makes should be customer centred. Customer focus helps the firm attain a superior understanding of the factors that influence a customer's buying behaviour and enables the firm to achieve a higher level of product differentiation (Prahalad & Ramaswamy, 2000). Prahalad and Ramaswamy reported that more than 650 000 customers were involved in testing Microsoft Windows 2000 and shared with the company their ideas for changing some of the product's features. Organisations acquire substantial and valuable information and knowledge regarding the market and customers through paying particular attention to the concept of customer focus (Yusr et al., 2014).

2.4.3. People Management in the context of TQM

People management revolves around how the workforce is enabled to develop and utilise its full potential, aligned with the company's objectives. Samson and

Terziovski wrote, “the issues addressed this category is how well the human resource practices tie into and are aligned with the organisation’s strategic directions” (1999, p. 396). In today’s business environment, people are regarded as being the most important asset for an organisation (Stewart & Ruckdeschel, 1998; Hassan et al., 2013). The concept of people management in TQM implementation is vital and is concerned with the involvement and empowerment of employees to take responsibility for the quality of their work (Zhang, 2000). This entails employees being engaged in various quality management activities, thus enabling their abilities to be used for the organisation’s benefit. Employees at all levels participate in planning, goal setting, and monitoring of quality-related issues. By participating, employees increase their personal capabilities, self-respect and commitment to the success of their organisation (Zhang et al., 2000). Giving suggestions for improvements is highly encouraged, with the sound ideas being implemented. They are invited to inform their seniors on conditions that need attention, such as poor tools and machines that need maintenance. By doing so, they acquire new knowledge, see the benefits of their participation, and get a sense of accomplishment through solving of quality problems. This TQM practice also encourages cross-functional teamwork in solving quality problems.

Yusr (2016) reckons that people management also involves building shared competences in an organisation through the training of its employees. Training gives the employees the technical and behavioural skills and knowledge to deal with the requirements of their jobs. This equips them with abilities to produce quality products. Organisations that implement TQM should invest heavily in training programmes for their employees (Zhang, 2000) and this should be an on-going exercise that equips the organisation to face ever-changing business environments.

Another aspect of people management in the context of TQM is having effective reward and recognition systems that are linked to quality performance, thus encouraging employees to support the organisation’s quality efforts. This means that the employees’ compensation system is linked to the achievement of specific quality goals, and should stimulate commitment, enthusiasm and creativity (Zhang, 2000; Hackman & Wageman, 1995). Zhang (2000) noted that both financial and non-financial rewards, such as praise letters, oral praise, and award ceremonies, are important.

Another characteristic of people management is the encouragement of participation in teamwork by forming cross-functional teams in solving quality problems (González & Guillen, 2002). These teams expose individual members to diverse viewpoints, as opposed to when working solely within their function units, thus allowing them to teach and learn from each other (Hackman & Wageman, 1995). The teams offer a platform for intense communication flows, as they are usually composed of a few members.

2.4.4. The multidimensionality of TQM

Extant literature has revealed that TQM is a multidimensional construct aimed at improving quality within an organisation. However, reference is also made of the dichotomous character of TQM. Different researchers have expressed this dichotomy using different terms, and have divided the TQM dimensions/constructs into various groupings. The common terms used include:

- Soft vs hard TQM elements
- Organic vs Mechanistic elements
- Philosophical (system) vs Mechanistic elements.

The soft, organic, and system or philosophical elements are those that are related to management concepts and principles. These TQM elements are thought to influence the organisational culture, employee morale and job satisfaction (Trivellas & Santouridis, 2009). The TQM elements that described as ‘soft’ are leadership, teamwork and empowerment, recognition and rewards systems, and communication.

On the other hand, the hard, mechanistic or hard elements refer to the documented dimensions of quality management, the primary function of which is to foster quality conformance in the organisation. TQM dimensions that fall into the hard category include customer focus, process focus, information, and analysis. The ‘hard’ elements are conceptualised as leading to organisational capability to improve production capacity and product quality. Despite the categorisation of TQM constructs into soft and hard groupings, there is no consensus among researchers on what exactly constitutes the soft or hard sides (Trivellas & Santouridis, 2009).

The literature reveals that the soft dimensions of TQM are the ones linked to positive relationships with innovation. For example, Hoang et al. (2006) found out that leadership, people management, and strategic management actions have positive relationships with innovation. However, customer focus, which has been ascribed to the mechanistic category, has been found to promote product conformance, rather than product innovation (Atuahene-Gima, 1996). Prajogo and Sohal (2004) concluded that the flexible elements are associated with innovation performance, while the mechanistic elements (hard elements) are only associated with quality, and the same conclusion was supported by Perdomo-Ortiz, González-Benito and Galende (2006; 2009). Therefore, TQM implementation can be manipulated to make it suitable to promote the quality and/or innovation objectives of organisations. The configuration of TQM elements would be different in organisations that target higher quality performance than those that target higher innovation performance.

Sitkin, Sutcliffe and Schroeder (1994) offered another side to the dichotomy of TQM, revealing that it consists of total quality control and total quality learning. Prajogo and Sohal (2001) asserted that total quality control is related to the mechanistic model, while the learning orientation is associated with the organic model. They argued that the TQM practices of the organic model promote innovation, while those related to the mechanistic model hinder innovation. Therefore, how TQM is implemented in organisations is crucial, as more emphasis on the mechanistic components may lead to a negative relationship with innovation, while the organic components result in a positive relationship.

One of the factors influencing TQM implementation is the external environment, with stable environments favouring the implementation of the mechanistic components, while highly volatile environments promote the organic components (Prajogo & Sohal, 2001). Turbulent or dynamic environments force firms to be innovative because, in such environments, short product life cycles are common.

The mechanistic–organic dichotomous nature of TQM was also dealt with by Martínez-Costa and Martínez-Lorente (2008). They pointed out that the mechanistic elements are favoured when an organisation is focused on controlling processes and products so that they meet and satisfy the established specifications. However, organic elements are favoured when the organisation is concerned with management and employee involvement and commitment. Such an organisation encourages training, learning, and internal cooperation as tools to achieve a common goal. Therefore, TQM orientation towards an organic or mechanistic model has a bearing on whether research findings show a positive or negative relationship between TQM and innovation. The mechanistic elements promote quality, while the organic elements foster innovation.

The external environment, as noted above, has a role in determining whether the organisation is inclined toward innovation or quality management. When the degree of uncertainty in the environment is high, organisations tend to be driven toward innovation, and in conditions of low uncertainty, toward quality management (Prajogo & Sohal, 2001).

2.5. Conceptualising Innovation

Joseph Schumpeter is considered to be the first researcher to popularise the importance of innovation (Rogers, 1998; Pekovic & Galia, 2009). He stressed the role that innovation played in entrepreneurship when he described it as a process of creating new products, new methods of production, a new source of supply, or a new organisational structure (Crossan & Apaydin, 2010). Innovation, through entrepreneurship, plays a major role in economic development and is often regarded as a source of competitive advantage (Abrunhosa & Sa, 2008). It is the basis on which an entrepreneurial business is built because of the competitive advantage it provides. Oke, Munshi and Walumbwa (2009) pointed out that Apple derived a huge success from technological, branding and business model innovations, while Southwest Airlines Co. relied on process innovations to offer highly successful, low-cost air travel.

The literature is replete, however, with definitions of innovation. According to Crossan and Apaydin (2010), innovation is “the production or adoption, assimilation and exploitation of a value-added novelty in economic and social spheres; renewal and enlargement of products, services, and markets; development of new methods of production; and establishment of new management systems” (p. 1155). Innovation includes the ability of an organisation to adopt or create new ideas and implement them to create new products or improve working processes. It represents a change in the status quo.

These authors stressed that innovation can be internally conceived or adopted from outside, and that it is more than a creative process as it stresses application. Their definition also captures the notion that refers to both relative and absolute novelty. A practice may be old in one company, but it may become an innovation for an adopting company. Therefore, innovation is not entirely a result of R&D work, but includes the adoption of something that is new to the adopting firm, even though it may not be novel to the industry.

According to Drucker (1986), innovation relies on the ability to notice change and to use it for business success. This definition has a strong inclination to customer orientation, as a change in customer needs present an opportunity to innovate and introduce new products or services. Innovation is the commercial adaptation of new processes, new technologies, and new products.

2.5.2. Innovation when viewed from the process or outcome perspective

Innovation is a multi-faceted concept that can be viewed from a process or an outcome perspective, a distinction which is sometimes blurred. The process perspective explores how new ideas are discovered, created, developed, commercialised or implemented, while the outcome perspective considers innovation as a product of the innovation process (Damanpour & Aravind, 2012). Quintane, Casselman, Reiche and Nylund (2011) noted that the activities constituting the process of innovation can be grouped two main phases, the idea generation phase, which includes all the steps from idea generation to the decision to implement the idea, and the implementation phase, which is concerned with an experimentation process in an effort to achieve an innovative result. The outcomes of innovations are the processes, products or services that an organisation would have developed as a result of the innovation process.

Scott and Bruce (1994) proposed that individual innovation is a three-stage process that begins with the recognition of a problem and then proceeds with the generation of novel ideas or solutions that can be adopted as a solution. In the second stage, the individual shares the idea for a solution and attempts to seek supporters for it. The last stage of the innovation process then involves the production of a prototype or model and its mass-production or diffusion.

By viewing innovation from an outcome perspective, the following aspects of it are often considered:

- Novelty or newness – representing the newness of innovation with respect to the firm, market or industry.
- Form – differentiating the various outcomes, i.e. product or service innovation, process innovation, and administrative or business model innovation.
- Magnitude – referring to the extent of innovation regarding its newness or novelty, resulting in it being either incremental or radical. The radical innovation is sometimes referred to as 'revolutionary', 'disruptive', 'discontinuous', or 'breakthrough'. Radical innovation involves fundamental changes and a clear departure from existing practices in an organisation, while incremental innovation represents variation in prevailing routines and practices. Radical innovations are crucial for invigorating true competitive advantage (Kemelgor, 2002).

2.5.3. Determinants of Innovation – the process perspective

It is important to analyse the determinants of innovation to explain why some firms become more successful in innovations than others do. Some of the common determinants of innovation identified in literature are decentralised organisational structure, organisational resources, communication channels, degree of risk propensity (Wan, Ong & Lee, 2005). These determinants are briefly described below.

- Decentralised structure – It is widely believed that informal and decentralised organisational structures facilitate innovativeness. These organisational structures encourage the generation of new ideas because they promote openness, greater lateral communication, and greater empowerment of lower level employees (Wan et al., 2005).
- Organisational resources – Resources are needed to pursue innovations before they can create value for the organisation, or to absorb the costs in cases of failure, or to even purchase innovations developed elsewhere. The resources needed for innovation are equipment and facilities, and the timing and supply of such resources is critical for the success of the innovation process (Scott & Bruce, 1994).
- Communication channels – These facilitate the internal flow and sharing of ideas, thereby promoting cross-fertilisation of ideas. The communication channels are easily formed when there are cross-functional teams within an organisation (Love & Roper, 2009).
- Risk propensity – Organisations that encourage risk-taking behaviours among their members are likely to pursue more innovation projects than those that do not. This is because such firms are more likely to tolerate possible failures, particularly if employees are acting in the interests of the customer (Wan et al., 2005).

It is important, therefore, to create an environment that supports innovation where people are willing and can innovate, because they are motivated and supported when they do so. Prajogo and Ahmed (2006) argued that specific practices necessary for building innovative behaviour are empowerment and involvement. Empowerment gives people the feeling that they possess a certain degree of autonomy, and feel less constrained by the rules and have self-efficacy in doing their work (Amabile & Gryskiewicz, 1989: Spreitzer, 1995). Spreitzer (1995) studied the effect of empowerment and found that it was positively related to innovative behaviours. The findings of these authors are further supported by the realisation that empowerment is closely linked to the concept of organic or decentralised structure, which has been found to be one of the best predictors of innovation.

An organisation also needs to create an environment that supports the creativity of employees and to provide resources necessary to exploit any opportunities available. Cross-functional teamwork plays a major role in stimulating creativity (Prajogo & Ahmed, 2006, Prajogo & Hong, 2008), as it promotes communication between different departments within an organisation. Intrinsic rewards, such as recognition of achievement, are also necessary for encouraging innovation (Prajogo & Ahmed, 2006). Drucker (1986) claimed that 3M promised to give an employee that come up with a highly successful innovation a senior management position in a subsidiary company born out of his or her innovation. In addition, Prajogo and Ahmed (2006) reported that 3M acknowledged that nearly 60 % of creative ideas fail, creating a sense that failure is not met with punitive or negative measures. A negative reward system discourages people from taking risks. This shows that innovation prospers when a conducive environment is present.

2.5.4. Product and Process Innovation

Product innovation refers to the production of new or improved products that can differentiate an organisation's product offerings in the marketplace (Damanpour, 1991, Damanpour & Aravind, 2012). Process innovation is concerned with process renewal aimed at improving quality and productivity of the products. It is concerned with enhancing the effectiveness and efficiencies of production (Bon, Mustafa & Rakiman, 2012). Damanpour and Aravind (2012) asserted that the determinants of innovation do not differentiate between process and product innovation, and that these two types are complementary rather than distinct. Prajogo and Sohal (2006) concluded from their research that process innovation plays a mediating role between quality and product innovation performance.

According to Fritsch and Meschede (2001), product and process innovations are interrelated, as product innovations demand new process innovations to enable a firm to produce completely different products or to improve their quality. Thus, new products stimulate and result from new processes, and product innovation cannot take place without parallel process innovation. Firms should pursue both process and product innovations if full benefits are to be derived, as these types of innovations are complementary.

Reviewing the work of other scholars, Damanpour (2010) concluded that a firm’s size has a more positive association with process rather than with product innovation. Small companies, with fewer resources, tend to spend on new products, rather than on new processes, because they perceive that with product innovations they can enter new markets more easily than when they have pursued process innovations. On the contrary, large firms favour process innovations because they have a comparative advantage in exploiting their current innovations in the marketplace.

The maturity of the market also plays a role in shaping the type of innovation that the organisation purses. Abernathy and Utterback (1988) have suggested that as markets become mature, there is a shift from product to process innovation and from radical to incremental product innovations. By pursuing major process innovations and incremental product innovations, firms can often open the market to a more diverse customer base until it reaches a mature stage.

2.5.5. Innovation and measurement

Rogers (1998) claimed that the measurement of innovation is often difficult because of the broad nature of the scope of innovation activities.

One form of measuring innovation is by way of analysing intellectual property (IP) output statistics, such as patents, trademarks and designs. However, the procedure for obtaining IP rights often embodies novelty and legality. At a firm level, the approach of using IP rights as a measure of its innovativeness is narrow-minded because the grant of IP rights only indicates an invention, which in one aspect of innovation. It would exclude innovations adopted from outside that are new to the adopting firm. In addition, seeking registration of IP rights is often costly, especially to small organisations, which tend to protect their innovations by way of secrecy rather than by patents. Furthermore, the use of patent data as a measure of innovativeness is often flawed, as that data does not relate to its commercial exploitation.

In some instances, successfully innovative firms often estimate a percentage of their sales that are accounted for by new or improved products. They measure their innovativeness by way of sales. The target of the highly innovative companies, such as 3M, is to derive at least 25 % of their revenue from new products.

2.5.6. The role of leadership in innovation

Leadership and top management play a critical role in the execution of successful innovation process, especially with regard to radical innovation that requires a level of learning, and change that is often disruptive, risky and costly (Prajogo & Ahmed, 2006; Jung et al., 2003). This is because leaders possess power and control over resources, both of which are crucial for radical innovation. According to Perdomo-Ortiz et al. (2006) and Lawson and Samson (2001), leaders also need to formulate goals that foster innovation, as well as provide necessary resources. Oke et al. (2009) noted that for innovations to succeed, they require a commitment of resources that are controlled by top management.

Leadership possess power and control resources which are needed to overcome organisational inertia to innovation. Transformational leaders shape the fertile environment (i.e. organisation culture) needed to nurture innovation through defining clear strategic goals, giving autonomy to the conduct of work, provision of challenging work, etc. They also shape the organisational characteristics such as the resources, rewards, strategy, organisational culture that support innovative behaviour (Amabile, Conti, Coon, Lazenby & Herron, 1996).

In organisations, top management support through providing resources for experimentation is essential to create a learning environment (Damanpour, 1991). He argued that physical and financial resources, as well as management and communication systems, are key ingredients for innovation practices.

Organisational culture is an important factor that supports innovation process. The role of leaders is to establish innovative culture by developing clearly stated, attainable, valuable shared vision (West, 1990) and by promoting autonomy (Amabile, 1998). Leaders control the resources and have power to reward for creative performance. When leaders provide intrinsic and extrinsic rewards for efforts to acquire new skills and to experiment with creative work, employees become more interested in creative endeavours (Jung, 2001). Redmond, Mumford, and Teach (1993) found that when leaders support constructive problem solving and the followers' self-efficacy, the followers display higher levels of creativity.

2.5.7. The role of customer focus on innovation

The role of customer focus in orientating organisations toward the products to produce has been extensively dealt with in literature (Prajogo & Sohal, 2001; 2004; Santos-Vijande & Álvarez-González, 2007). They contend that customer focus leads to incremental innovations as organisations adapt to evolving customer needs.

Santos-Vijande, Sanzo Pérez, Álvarez-González and Vázquez-Casielles (2005) have argued that customer orientation promotes proactiveness and aggressiveness, which are the two components of strategic behaviour that are critical for innovative behaviour. The firm needs to aggressively allocate resources with a view to be the first in the market to capture new market opportunities. The continuous searching for customer needs exhibits a firm's proactiveness to be the first in the market. Proactiveness and aggressiveness are therefore two essential elements of innovative behaviour.

Santos-Vijande and Alvarez-Gonzalez (2007) argued that a well-understood principle of customer focus implies the gathering of information on both current and future customer needs, “taking into account all the environmental forces that could shape their expectations” (p. 517). This enables organisations to anticipate the most novel latent needs of future customers so that it can radically innovate.

Martínez-Costa and Martínez-Lorente (2008) argued that an organisation needs to fully understand the needs and preferences of customers to enable it to develop appropriate products, and is thus guided by them in its innovation efforts. Ahire et al. (1996) contended that “organisations outperform their competition by being able to:

(1) respond quickly to customers’ demands with new ideas and technologies,

(2) produce products that satisfy or exceed customers’ expectations and

(3) anticipate and respond to customers’ evolving needs and wants” (p. 28).

Feedback received through customer surveys and customer complaints are often used as input into planning, design and manufacturing in order to improve product quality (Zhang, 2000) and develop new products.

Too much customer focus inhibits organisations in reconceiving their market boundaries or breaking new ground. The biggest problem with customer focus is in asking customers what they want, as their views are often based on how they perceive the existing markets. Radical innovations, to which public reaction is unknown, are often limited (Santos-Vijande & Alvarez-Gonzalez, 2007). Also, Steve Jobs is reputedly quoted to have said that many times, people do not know what they want until they are shown the product. It is therefore not surprising that Apple created new products that radically redefined the markets without relying on customer focus.

2.5.8. The role of People Management in innovation

Love and Roper (2009) noted that cross-functional teamwork is essential in promoting trust and knowledge sharing among workers, and it offers one of the most efficient channels of communication, which has been recognised as being an important driver for organisational innovation. However, Santos-Vijande and Álvarez-Gonzalez (2007) argued that although teamwork is essential for innovation, “it is a threat to individual creativity and independent innovative spirit” (p. 518).

Amabile et al. (1996) argued that autonomy is critical for organisational creativity, as individuals tend to be more creative when they perceive that they have more personal control over how to accomplish their daily work. They are then empowered and are more likely to be intrinsically motivated (Jung & Sosik, 2002).

Jung and Sosik (2002) claimed that creativity could be influenced at individual, group and organisational levels. The key issues at individual level are technical knowledge, personality, expertise, motives, and supervisor’s feedback style, while at the group level, aspects such as task structure, communication types, and task autonomy are important. Strategy, organisational structure, culture and climate, and availability of resources are crucial determinants at an organisational level. Therefore, people management is critical in determining innovation performance.

2.6. The TQM–Innovation Relationship

In the main, Prajogo and Sohal, (2001, citing the work of Zairi, 1999), reported that some world-class firms, such as 3M, HP, AT&T, and Exon Chemical, had shown great innovation management that had TQM elements in them. This underlines the role of relationship between TQM and innovation. Several empirical studies conducted have indicated that the implementation of TQM practices enhances a firm’s quality and economic performance (Kaynak, 2003; Demirbag et al., 2006; Samson & Terziovski, 1999). More importantly, applying TQM practices helps a firm build and provide capabilities that are key for innovation performance in that firm (Yusr, 2016). TQM practices, such as leadership, customer focus, people management, and process management, support an organisation with several resources, such as skills, knowledge, experience, relationships, tools, communications systems that build the organisation's capabilities essential for innovation activities (Yusr, 2016; Yusr et al., 2014). The preceding sections draw out the hypotheses concerning the relationships of TQM constructs of leadership, customer focus and people management, and innovation.

An organisation can pursue either or both product or process innovations, depending on the competitive drivers which the organisation faces.

2.6.2. Customer focus in the TQM–Innovation relationship

Flynn et al. (1994) reported that there are certain elements of TQM, such as customer focus and continual improvement, which foster the innovation process. Prajogo and Sohal (2001) pointed out that customer focus constitutes a stimulus to innovation because it pushes firms to consistently scan the needs of the customer in order to make products that match those needs. By doing so, it provides a clear alignment of innovation by linking it with customer needs. Manders et al. (2016) qualified this further by arguing that this promotes only incremental innovation, but hinders radical innovation. They claimed that it promotes adaptive learning, rather than generative learning that is crucial for radical innovation.

Slater and Narver (1998) have posited that customer focus limits an organisation to not looking beyond their existing customers, and therefore it fails to anticipate future market changes. When changes come, such firms would not be prepared to deal with them, as they would be preoccupied with becoming good in what they do and serving their current customers. In addition, Cole and Matsumiya (2007) reported that the ability of a company to innovate, by introducing new products and services, would be constrained by fear to disturb the current way of doing business with their existing customers. They become risk averse.

Some researchers propose that TQM is more ‘market pull’, while innovation is more ‘product push’ (Prajogo & Sohal, 2001). The customer focus mindset might trap organisations into pursuing mostly incremental improvements in their current products and services, neglecting the need to create new ones through radical innovation. Organisations tend to be reactive to customer needs and therefore fail to search for latent needs (Prajogo & Sohal, 2001). Organisations, therefore, fail to drive generative learning that comes from searching for the unserved, untapped potential markets. In addition, customer focus leads to the development of a long-term relationship with existing customers who might constrain the firm’s ability to innovate because of the fear of “unsettling” the already established way of doing business with the current customers (Wind & Mahajan, 1997).

With market orientation, Santos-Vijande and Alvarez-Gonzalez (2007) have argued that as soon as opportunities are detected, resources are immediately made available to exploit those opportunities and capture the advantages associated with being the first to market. Therefore, the organisation can develop new products faster and develop new markets.

According to Perdomo-Ortiz et al. (2006), customer focus helps organisations to align their strategy with their technological capabilities and mobilise resources and innovative ideas to meet customer needs. Santos-Vijande and Alvarez-Gonzalez (2007) posit that customer focus leads to excessive focus on incremental innovation, as the firm continuously adapts to the evolution of customer needs. In that situation, radical innovations to meet the latent needs of the market are often neglected. Market research beyond the existing customer base is often neglected. Adaptive learning, rather than generative learning, subsists. Adaptive learning occurs when a firm limits itself to opportunities confined to its current markets, often exploiting the prevailing patterns of behaviour or mental models. On the other hand, generative learning often accompanies radical innovation where much creativity is involved.

Some authors do not consider customer focus as a source of innovation, as they contend that it is limited to incremental improvements and worse products in the long term, as it does not encourage the creation of products outside the scope of their existing customers. In this way, radical innovations are hindered (Santo-Vijande & Alvarez-Gonzalez, 2007). Wind and Mahajan (1997) argued that customer focus narrows the attention of the organisations to current products and services only, and therefore is limited to incremental improvements rather than novel ones.

Other researchers (Prajogo & Sohal, 2004a; Singh & Smith, 2004) propose that customer focus hinders innovation as it forces firms to focus on the current customer needs, and so they often ignore latent needs because the customers are often unable to express their needs beyond their current consumption experiences (Abrunhosa & Sa, 2008). Based on the arguments presented so far, the following hypotheses can be set:

Hypothesis 1: TQM dimension of customer focus has a positive relationship with product innovation.

Hypothesis 2: TQM dimension of customer focus has a positive relationship with process innovation

2.6.3. Leadership in the TQM–Innovation relationship

The role of leadership is to establish unity of purpose and direction for the organisation by setting challenging quality goals and targets that match the vision of the organisation. Therefore, if an organisation desires to achieve both high-quality and innovative performance, it formulates suitable objectives and strategies to achieve that, and then aligns operational activities to achieve those targets. The leadership would create an environment of trust, encouraging employees to contribute their ideas freely, and support both quality improvement and innovation by providing the needed resources. This will lead to more employee contributions as they feel that their ideas are appreciated (Prajogo & Sohal, 2004).

Prajogo and Sohal (2006) posit that from a quality perspective, firms may be pushed to adopt process innovations in order to meet an updated standard of quality (i.e. specification) that could not be met using existing processes. They found a strong positive linkage between process innovation and product innovation, and concluded that the creation of a new product sometimes leads to the adoption of process innovation, and vice versa.

In their study of Malaysian industry, Lee et al. (2010) found that leadership is positively related to product innovation. A similar relationship was ascertained by Hoang et al. (2006), who showed that in terms of the level of newness, leadership positively influenced product innovation.

The following hypotheses can, therefore, be made:

Hypothesis 2: TQM dimension of leadership has a positive relation with product innovation.

Hypothesis 3: TQM dimension of leadership has a positive relation with process innovation.

2.6.4. People Management in the TQM–Innovation relationship

Research has shown that, central to the innovation process in an organisation, is the innovative behaviour exhibited by employees in response to signals they receive concerning organisational expectations for behaviour and potential outcomes of innovative behaviour (Scott & Bruce, 1994). They proposed that people use this information to formulate expectations and therefore regulate their behaviour.

People management is concerned with employee empowerment and involvement. Employees are empowered to inspect their own work and take corrective action, or even stop the process, if production is out of control (Ahire et al., 1996, Prajogo & Sohal, 2001). This approach is effective when the employees are provided with the necessary resources and technical support to accomplish their work. Martinez-Costa and Martinez-Lorente (2008) argued that TQM promotes empowerment, which has been known to play a major role in fostering creativity in an organisation. Prajogo and Sohal (2001) also referred to the fact that cross-functional communication is enhanced in TQM environment and this is crucial in fostering organisational innovation. These arguments support a positive relationship between TQM and innovation.

Amabile and Gryskiewicz (1987) have suggested that collaborative effort among peers is critical in idea generation. This underlines that fact that sharing of ideas is crucial to the innovation process.

The TQM construct of people management argues that the involvement of individuals at all levels of the organisation by devolving responsibilities and a sense of ownership so that all the individuals understand their contribution and their roles in the organisation. Manders et al. (2016) propose that if an organisation is pro-innovation, empowering its employees gives them greater autonomy and responsibility which are essential for them to be innovative. People will generate more ideas if they know that they are valued by management (Santos-Vijande & Álvarez-González, 2007).

On the other hand, some researchers have found that people involvement and teamwork have a negative effect on innovation. Ahanotu (1998) argued that under a TQM environment, employees have no time to participate in non-productive activities and this reduces their chances to innovate. Prajogo and Sohal (2001) also argued that TQM kills individual creativity as it encourages working in groups. Based on the foregoing discussions, the following hypotheses can be made:

Hypothesis 5: TQM dimension people management has a positive relationship with product innovation.

Hypothesis 6: TQM dimension of people management a positive relationship with process innovation.

2.7. Research Framework

Based on the preceding discussion, the conceptual framework of the study is illustrated in Figure 2.2 below.

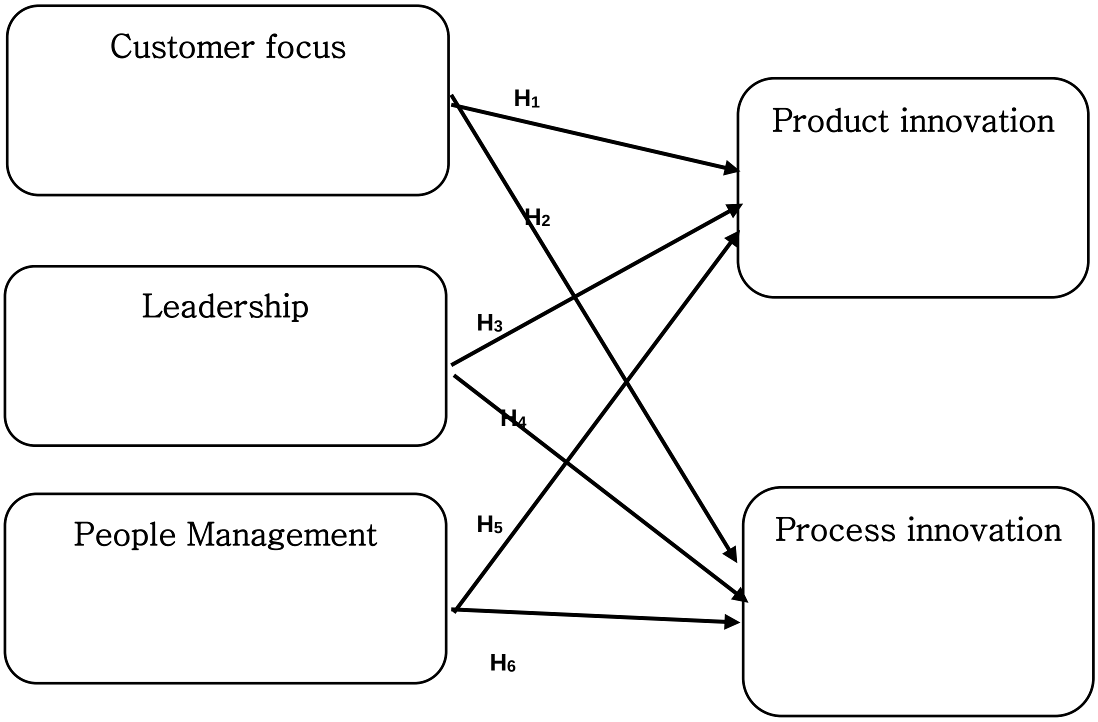

Figure 2.2: Conceptual framework of the study

2.8 Conclusion to literature review

In spite of the number of research works conducted so far, there has been no decisive agreement reached on the impact of TQM on innovation. To the knowledge of this researcher, there has not been any such research done in Africa on the relationship of the two and using a sample that includes a broader spectrum of employees other than only the senior personnel in an organisation. Previous work has concentrated on the perception of management employees only, and this work will involve shop-floor employees. The intention of this is to assess the extent of TQM deployment in the organisation, and to uncover situations where TQM exists only on paper.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the methodology that was followed to conduct the research is thoroughly described. The chapter begins with a discussion on the research paradigm adopted, followed by the research design that articulates the independent variables and dependent variables utilised. A conceptual framework is given to graphically depict the envisaged relationship between the variables. This is followed by a section on the target population and sample of the study, sampling technique, the research instrument used, the data collection technique, and how the data will be analysed and construed.

3.2 Research Paradigm

In this study, a positivist approach is adopted. According to Guba (1990), the positivist paradigm has a belief system that is rooted in the realist ontology. This contends that there is a reality out there that is driven by unchallengeable natural laws, and the purpose of study is to discover the "true" nature of reality and how it works. Veenstra (1999) defined a positivist approach as "an organised method for combining deductive logic with precise empirical observations of individual behaviour in order to discover and confirm a set of probabilistic causal that can be used to predict general patterns of human activity" (p.18). The epistemological assumption is the independence of the researcher from the object of research, thereby limiting the influence of the researcher on the results. Thus, the researcher adopts a distant, non-interactive posture, enabling any possible influence to be detected and be accounted for (Guba, 1990). Therefore, biases and other confounding factors that may influence the outcome are automatically excluded.

With the positivist paradigm, the most appropriate methodology is empirical experimentalism, which denotes that questions and hypotheses are stated in advance in a propositional manner and are subjected to falsification efforts using quantitative surveys, experiments and statistics (Guba, 1990). Therefore, a quantitative research methodology was used to collect data on observed characteristics of the population and then to apply statistical evaluation techniques to deduce interrelationships.

3.3 Research Design

The purpose of a research design is to detail the procedures for collecting and analysing the data needed to accomplish the research objectives (Cooper & Schindler, 2014). This entails specifying the type of information needed to answer the research questions, and testing the theory that has been proposed. It is a master plan of the study, detailing how the study is to be conducted.

In this study, a cross-sectional design was used, and as it is an observational study, this entailed data collection using a questionnaire or other instruments in a single moment in time, without manipulating the study environment. This design was selected because it is relatively inexpensive and can be concluded within a short time frame. The limitation of this design is that causal inferences cannot be made, as it represents a snapshot in time and if another timeframe had been chosen, different results might have been obtained. The other drawback is that it uses predetermined questions which may fail to completely comprehend the respondents' perceptions (Nadler, 1977).

3.3.1 The TQM constructs

Extant literature has revealed that different researchers have defined different TQM constructs in their studies. Black and Porter (1996) established 10 TQM practices after they conducted factor analysis of a questionnaire administered to quality practitioners; Saraph et al. (1989) identified eight dimensions; while the version of Ahire et al. (1996) was similar to that Black and Porter, but included product quality as a construct. This illustrates the point that there has been no consensus on what the "real" TQM dimensions are (Samson & Terziovski, 1999). The Malcom Baldrige National Quality Award (MBNQA) consists of six practices, namely leadership, customer focus, information and analysis, people management, process management and strategy, and planning. The usefulness of MBNQA in defining TQM practices has been widely recognised (Samson & Terziovski, 1999). The work by Dean and Bowen (1994) had three dimensions of TQM, which are continuous improvement, teamwork, and customer focus. The authors proposed that these dimensions are supported by a wide array of techniques.

This study will focus on the three constructs of leadership, customer focus, and people management. Leadership is a key element of TQM as it concerns the senior executives and management's involvement in building and maintaining an environment conducive for TQM implementation. This is critical as it unleashes unity of purpose, gives employees power to implement their ideas without seeking approval, and encourages change. It determines the successful implementation of other TQM constructs. Customer focus addresses customer needs and expectations, meaning that customer-centric organisations are better placed to produce products that are relevant to their customers. People management relies on the involvement and participation of employees in all quality-related activities. This study is limited to the study of these three constructs to establish their relationship with innovation.

3.3.2 Innovation measures

Literature reveals variations in the methods used to measure innovation performance in organisations. This is attributed to the broad scope of innovative activities (Rogers, 1998). Rogers (1998) suggested linking the innovation measures to the input and output of innovative activity in a firm. The ultimate output of innovative activity is the success of the firm, which can be measured through profits, revenue growth, productivity, etc., but these can be caused by factors other than the level of innovation. Variables that measure innovative activities in terms of the number of new product or services, processes, markets and new materials seem to be more appropriate.

Prajogo (2006) suggested that innovation measures are based on four characteristics of innovation, which are the number of innovations, the novelty of innovation, the speed of innovation, and the extent of aggressiveness in adopting innovation, which is represented by being first in the market. The increasing number of innovations has been necessitated by the shortening of product life cycles that demands that firms need to innovate more often to replace products more frequently with better versions. There is a need to achieve this faster than competition does, hence the need to measure the speed of innovation. In order to meet the demands of faster innovation, firms need to adopt the latest technology that will enable them to introduce those new products faster. Another variable linked to innovation is the early market entry that will enable the innovative firm to harvest benefits before competition emerges. Firms that create new markets enjoy the “first-mover advantages” (Makadok, 1998). The factors discussed above form the variables which were used to study the constructs of innovation.

The types of innovation can be categorised in various ways, namely product (service) innovation, represented by the new or improved products or service; process innovation, which entails new or better ways of producing products or delivering services; and administrative innovation, which is concerned with the organisational structure of the firm that better supports the creation, production and delivery of products and services (Prajogo, 2006). The author argued that the product and process innovations are the most prominent, and that the dividing line between them is often blurred and confusing (Tidd, Bessant, Pavitt & Wiley, 1998). These two are sometimes referred to as technological innovations. The two indicators of the output of innovation used in this study are product innovation and process innovation.

Table 3.1 below presents the independent and dependent constructs used in this research, and is compared with other instruments available in extant literature. Although the essence of what was measured was the same, judging from the statements used, different authors used different headings for the constructs. For example Kim et al (2012) refer to customer focus and people management as customer relations and employee relations respectively. In addition, Kim et al. (2012) delineated both product and process innovations into radical and incremental while Ooi et al (2012) measured innovation as innovation performance.

Table 3.1: Construct Comparison Table as used by different researchers

	This researcher's Instrument	Km et al. (2012) Instrument	Prajogo & Sohal (2006) Instrument	Ooi et al. (2012)
Customer Focus -	*7 items*	4items	4 items	5 items
***Leadership*.**	*6 items*	6 items	6 items	7 items
People Management	*7 items*	4 items	5 items	7 items
Product Innovation	*4 items*	11 items (5 for radical and 6 for incremental innovation)	5 items	8 items (measured as innovation performance)
Process Innovation	*4 items*	6 items (3 for radical and 3 for incremental innovation)	2 items	

3.4 Population

According to the database made available to this researcher by the South African Institute of Foundrymen Management, there are about 50 ISO 9001 certified foundries in South Africa, employing about 7000 employees. This is the target population of this study. The results of this research will only be generalised for the foundry industry, as this study is industry specific. The reason to focus on the employees in this study has been motivated by the fact that TQM can be considered as an organisational capability centred on the involvement of all employees in an organisation, and accordingly their perceptions of the TQM practices and adoption in their organisation are really important. Most studies in literature have concentrated on senior management as respondents, but this study attempted to capture wider perceptions by requesting one management representative, quality assurance officials, supervisors, and shop-floor employees to respond, where possible.

3.5 Sample and Sampling Technique

According to Barlett, Kotrlik and Higgins (2001), the determination of the sample size to use in studies is essential within the realm of quantitative survey design in order to enable inferences for the study population to be made from the results of the study sample. More accurate generalisations that reflect the population are obtained with larger samples, but factors such as time and resources needed for data collection, as well as requirements of the statistical techniques to be used, also play a role in determining a feasible sample size (Saunders, Lewis & Thornhill, 2009). Barlett et al. (2001) proposed that in order to use multiple regression analysis, the observations should be more than five times the number of independent variables, otherwise there is risk for overfitting, thus giving results that lack generalisability. Although Hair, Black, Babin and Anderson (2010) concur with this minimum, they suggested that between 15 and 20 observations for each independent variable, to ensure generalisability, is more appropriate. They also contend that observations greater than 1000 make the statistical significance tests overly sensitive. In addition, they reported that a minimum of 100 observations is required, if factor analysis is to be used.

In this study, a rule of thumb formula of $N \geq 50 + 8 * m$, where m is the number of independent variables, is used for determining the sample size. The non-probability purposive sampling technique was employed to select the units of the sample. With this technique, the researcher uses his or her judgement in identifying the sample units. The sampling unit proposed is made up of representatives of the following groups: management, supervisor, quality department personnel, and shop-floor employees. The drawback of a purposive sampling technique is that it is difficult to discern whether the chosen sample is truly reflective of the population. In this study, the researcher relied on his network as a member of the South African Institute of Foundrymen to contact potential respondents. A total of 250 questionnaires were sent out.

3.6 The survey Instrument

The survey instrument used in this research was adapted from the work of Prajogo and Sohal (2004), Zhang et al. (2000)**,** Ooi et al. (2012) and Kim et al. (2012), and has 20 items measuring TQM practices, comprised of 6 items for the leadership construct, 7 for customer focus, and 7 for people management. The innovation constructs are measured by 8 items consisting of 4 for product innovation and 4 for process innovation. The study was limited to 28 items to minimise the chances of respondent fatigue, as the previous studies elsewhere showed low response rates (Kim et al., 2012).

The instrument used set out a seven-point Likert scale, representing a range of attitudes from strongly disagree, disagree, somewhat disagree, neutral, somewhat agree, agree, to strongly agree. These were assigned numbers 1 through 7, respectively, such that statistical tools could be used for data analysis. The research instrument also solicited information about the characteristics of the firm and the respondent. This information included the number of employees, gender and position of the respondent in the firm, number of years the firm had with ISO 9001 certification, etc. A copy of the instrument used is included in Appendix A. Since certification is not mandatory, companies that are in the process of acquiring certification were also included, as they have been deemed to have implemented the TQM practices. Certification is not mandatory, according to ISO 9000 standards (Hoyle, 2003).

3.7 Data Collection

The data was collected using a self-administered instrument. This implies that the questionnaire would be completed by respondents themselves (Saunders et al., 2009). An introductory cover letter, copy attached in Appendix A, was sent with the questionnaire to the firm’s gatekeeper at the ISO 9001 certified foundry, after an initial telephonic request for the organisation to participate in the study. The cover letter informed the potential respondent of the purpose of the research, issues pertaining to protection of privacy, and confirmed that participation was strictly of their own volition and that no undue pressure was being put on them. After one week of emailing the questionnaire, follow-up telephone calls were made to remind the respondents. Follow-up emails, with another copy of the questionnaire, were sent if feedback had not been received after two weeks. To increase the response rate, the researcher in some cases also personally handed copies of respondents to participants as they could not respond to emails.

3.8 Data analysis and interpretation

As the raw data was received, it was tabulated in an Excel spreadsheet, cleaned for missing data and incorrect entries, before being imported into the SPSS program for further data analysis. Descriptive data analysis was then done to characterise the respondents in terms of the level of seniority in the company, size of foundry, and number of years of having adopted the ISO 9001 management system. Hair et al. (2010) proposed that before any data analysis is performed, the assumptions correlating the size of the sample, scales of variables, multivariate normal distribution and outliers, and their multicollinearity should be checked first (Lee et al., 2010). The psychometric properties of the constructs being tested in the research are also checked by evaluating their reliability and validity values.

3.8.1 Reliability

Reliability deals with the ability of the instrument to measure and give results that are reproducible in repeat experiments (Zhang, 2000). Although there are four methods that can be used, the commonly used one is the internal consistency method. This technique involves calculating a statistic known as Cronbach’s coefficient alpha, whose value should be 0.7 or more, if results are to be considered as reliably good (Hoang et al., 2010). Values of between 0.6 and 0.7 may be accepted if other conditions of construct validity are satisfied (Yusr, 2016). The Cronbach’s coefficient alpha is calculated using the SPSS software and it indicates how well the different items measure the same concept. Individual item values will be checked, and the items with low values will be deleted if there is any need to increase the Cronbach's alpha (Hair, Black, Babin, Anderson & Tatham, 2010).

3.8.2 Validity

Confirmatory factor analysis (CFA) is employed in assessing the capacity of each individual item in measuring the scale and checking construct independence (Hair et al., 2010). This measures if the items used to measure each construct "belong together" as indicators of that construct, and this is termed convergent validity. The primary statistics of interest in CFA are the factor loadings which measure the strength of relationship between manifest variables and latent factors (Lee, 2016). The factor loadings can take any value between 0 and 1, and the higher the factor loading is, the stronger the item is considered to be measuring the desired construct. Confirmatory factors analysis was carried out using SPSS software. The loading values for each item on a particular construct are evaluated, and deleted if cross-loading and/or poor loading of less than 0.5 is detected (Zikmund, Babin, Carr & Griffin, 2013). A method called rotation may be employed to produce easily interpretable factor loadings and this can be accomplished by the analysis software. A scree plot is also used to determine the factors extracted.

3.8.3 Correlation analysis of Constructs

Bivariate statistical analysis will be conducted using SPSS software to determine correlation coefficient, which is a statistical measure of association between two variables (Zikmund et al., 2013). The Pearson correlation coefficient statistic, r, can take any number that ranges from -1.0 to +1.0. The negative values indicate a negative relationship of the variables in question, while a positive value indicates a positive relationship. A standardised measure of covariance, known as the Pearson correlation coefficient, will also be evaluated and can be used to compare correlations of all the constructs. The results will be presented in a correlation matrix, which is a standard form for reporting correlations.

3.8.4 Multiple Regression Analysis

Hair et al. (2010) affirmed that multiple regression analysis is a technique used to analyse the relationship between several independent variables and a dependent variable. In this research, six regression analyses were run to test each of the hypotheses posited (see section 2.7 Research Framework). The main parameters of focus are the beta (β), with its accompanying statistical significance level (p-value), and the adjusted coefficient of determination (adj. R^2) which relates to the amount of relationship that can be explained (Zikmund et al., 2013). The positive value of β indicates a positive relationship between the independent variable and the dependent variable, while a negative value indicates a negative relationship (Zikmund et al., 2013).

The β value can theoretically take any value in the range -1 to +1. The coefficient of multiple determination, R^2, represents the percentage of variation in the dependent variable that can be explained by a combination of all the independent variables (Zikmund et al., 2013). The regression results can be compared with the bivariate correlation results. Another parameter of importance in multiple regression analysis is the multicollinearity value, which measures how strongly interrelated the independent variables are. Correlation values of independent variables of approximately 0.9 or above may cause multicollinearity and will make multiple regressions results unreliable (Lee, 2016). The results of the regression analysis can therefore be used to reject the null hypothesis, or to fail to reject the null hypothesis.

3.9 Conclusion

Chapter three explored the methods used in this study. It commences by adopting a positivist research paradigm and then discussed the TQM and innovation constructs. The population and sampling technique of the study were presented. The research instrument was then described and how its reliability and validity would be tested. The chapter was concluded by describing the linear regression as this would be used to test the relationship between independent and dependent variables.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.1 Introduction

This chapter presents all the results obtained in this research and details the analyses done on the data in order to test the hypotheses which are postulated in Chapter Two. This culminates in the acceptation or rejection of the hypothesis.

4.2 Profile of Respondents

This section profiles of the respondents who participated in this research by giving information about the individuals as well as that of the firms.

4.2.1 Questionnaire Response Rate

The questionnaire email was sent to the gatekeeper of each purposefully selected organisation with the request to distribute it to at least five of its employees, representing the following categories: management, quality assurance/quality control department, supervisory, shop floor and *other*. The category *other* represented those in sales, procurement, office staff, etc., and their inclusion was to gauge the level of TQM implementation within the organisation since TQM in its true form embraces all aspects of the organisation, involving its entire workforce, as well as its customers and suppliers (Abrunhosa & Sa, 2008). The email contained a web-link to the survey which was saved on the Qualtrics website, which respondents would access to complete the survey. However, the response rate was very low, despite numerous follow-up telephone calls. The researcher then decided to hand-deliver hard copies of the questionnaires to the organisations. Of the total of 250 sent out, only 32 responses were received back by the electronic system using Qualtrics with the rest collected manually. The in-person interaction helped in getting more responses back, giving a total of 92, with 9 of them partially completed, which had to be discarded.

4.2.2 Profile of the Respondents

Table 4.1 below presents the categories of the respondents that participated in this research. The results show that the majority of the respondents were in management positions. Although the intention of the study was to involve a wider spectrum of employees in order to ascertain how deep the TQM practices are entrenched in the organisational systems, the results indicated the reluctance of management, as the gatekeepers, to allow lower levels of employees to express their views about the company to outsiders. This reservation was expressed by some gatekeepers to this researcher during the in-person data collection visits.

Considering that most respondents were from the management category, it is not surprising that males dominated in respondent gender (75.7 %) since it is a general trend in South Africa that few females occupy management positions. The only drawback was that fewer shop floor employees were involved in the survey.

The firm sizes were grouped, depending on the number of permanent employee, as follows: 1–49 (small), 50–200 (medium), 201–500 (large), and above 500 (very large). The results show that most foundries are in the medium category, with 50–200 employees. In addition, most of the firms had been quality management certified for a period of more than 10 years. It can therefore be inferred that most of the firms had been in existence for more than ten years.

Table 4.1: Profile of respondents

Occupation			Gender		Age of Certification		Number of Employees	
Category	**Number**	**Frequency (%)**	**Gender**	**Frequency (%)**	**Age**	**Frequency (%)**	**Size**	**Frequency (%)**
Management	37	44.6	Male	74.7	0-1yrs	16.9	0-49	20.5
QA/QC department	16	19.3			2-5yrs	10.8	50-200	55.4
Supervisory	11	13.3			6-10years	20.5	200-500	19.3
Shop-floor employees	6	7.2	Female	25.3	Over 10years	51.8	Over 500	4.8
Other	13	15.7			**Total**	**100**	**Total**	**100**
Total	**83**	**100**						

4.3 Assessment of Scale Items

This section presents an overview of the different scale items used to measure the constructs in this study. Firstly, each set of scale items was evaluated using descriptive statistics, highlighting the key information that could be deducted. Then, the reliability of the scale items was assessed using the Cronbach's alpha criteria. Finally, the validity was tested using the factor analysis. The three dimensions of TQM studied in this work were customer focus, leadership, and people management as independent variables, while the dependent variables were product and process innovations.

4.3.1 Scale items relating to customer focus

4.3.1.1 Descriptive analysis of results

The results in Table 4.2 below reflect that most respondents agreed or strongly agreed (averaging 72.5 %) with the statements measuring the implementation of the customer focus principle as part of the TQM system. This affirmed the view that this construct is well entrenched within most of the organisations that participated in this research. It is not surprising to note that the response to item CF1 indicated that most organisations pay enormous attention to their customers, as most foundries are jobbing foundries. These are the foundries that manufacture components specifically ordered by their customers, instead of manufacturing to sell to any potential customers that may use the product.

Table 4.2: Frequencies for the scale items for customer focus

		Percentage (%) frequency of responses						
	Scale Items	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	disagree	Strongly disagree
CF1	Needs and expectation of customers regularly sought.	42.2	39.8	12.0	4.8	1.2	0	0
CF2	Needs and expectations of customers are always communicated to employees.	26.5	45.8	22.9	3.6	1.2	0	0
CF3	Customer complaints relating to quality are given top priority.	38.6	41.0	8.4	1.2	3.6	0	7.2
CF4	Our customers freely communicate with us to maintain close relationship.	47.0	38.6	13.3	1.2	0	0	0
CF5	Customer complaints are resolved effectively.	32.5	49.4	14.5	2.4	0	1.2	0
CF6	Customer satisfaction is measured regularly.	20.5	41.0	20.5	12.0	4.8	1.2	0
CF7	We do market research to collect ideas on product improvements.	14.5	30.1	25.3	20.5	4.8	4.8	0

Table 4.3: Descriptive statistics of scale Items

		Descriptive Statistics – Customer Focus				
	Scale Items	Mean	Std Deviation	Mode	Skewness	Kurtosis
CF1	Needs and expectation of customers regularly sought.	6.17	0.908	7	-1.145	1.220
CF2	Needs and expectations of customers are always communicated to employees.	5.93	0.866	6	-0.665	-0.566
CF3	Customer complaints relating to quality are given top priority.	5.81	1.626	6	-1.998	3.392
CF4	Our customers freely communicate with us to maintain close relationship.	6.31	0.748	7	-0.766	-0.162
CF5	Customer complaints are resolved effectively.	6.08	0.872	6	-1.521	4.851
CF6	Customer satisfaction is measured regularly.	5.57	1.160	6	-0.813	0.292
CF7	We do market research to collect ideas on product improvements.	5.14	1.308	6	-0.542	-0.151
Composite statistics		6.012	0.672	6	-0.716	0.138

NB. Items CF3 and CF7 were not included in calculating the composite values as they were deleted based on reliability results.

The descriptive statistics for items pertaining to customer focus are presented in Table 4.3 above. Mean scores are evenly distributed on the high end of the scale, with standard deviations being fairly moderate. The results show negative skewness owing to the fact that most respondents agreed with the presence of customer focus practice in their organisations. The skewness for CF1, CF3 and CF5 are above the limit of +/-1, indicating non-normality in the data. Both positive and negative kurtoses were obtained, indicating leptokurtic and platykurtic distribution of the scores.

CF3 show the largest standard deviation, indicating the diverging perceptions among the respondents on the whether the customers' quality-related complaints are treated with priority. The implication of diverse assessment can be attributed to the diversity of the positions of participants.

4.3.1.2 Reliability test for the customer focus scale items

The Cronbach's alpha for the customer focus construct are Presented in Table 4.4 below, with a computed value of 0.724 when all the items were considered. This was found to be slightly above the minimum of 0.7 (Hair et al., 2010). By deleting item CF3, the Cronbach's alpha increased to 0.776, as well as increasing the corrected inter-total correlations of items CF6 and CF7. Item CF7 was again deleted, with the alpha coefficient of 0.782 being obtained and thereby improving all the remaining corrected inter-total correlations to values above the cut-off of 0.5.

Table 4.4: Reliability results of customer focus scale items

Scale Items	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation
CF1	0.672	0.544	.737	.549	0.764	0.487
CF2	0.660	0.615	.724	.611	0.715	0.640
CF3	0.776	0.236	-	-	-	-
CF4	0.687	0.507	.747	.530	0.753	0.530
CF5	0.669	0.566	.738	.550	0.729	0.596
CF6	0.679	0.483	.731	.571	0.743	0.578
CF7	0.703	0.404	.782	.433	-	-
Total Alpha	**0.724**		**0.776**	-	**0.782**	

4.3.1.3 Factor Analysis for the customer focus scale items

Presented in Table 4.5 below is the correlation matrix obtained after running factor analysis on the remaining customer focus items after deleting CF3 and CF7. All the coefficients were found to be above 0.3 and were statistically significant at p-value $p < 0.01$, with the determinant of the matrix being reported as 0.255, which is greater than the 0.00001 limit for a valid factor analysis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.799 was obtained, indicating sampling adequacy as this figure is above the recommended minimum value of 0.6. This was supported by the Bartlett's test of sphericity with the following values: approx. chi-square = 139.197, df = 21, sig. = 0.000.

Table 4.5: Correlation matrix for the customer focus scale

Correlation Matrix						
		CF1	CF2	CF4	CF5	CF6
Correlation	CF1	1.000	.372	0.352	0.320	0.441
	CF2	0.372	1.000	0.468	0.541	0.514
	CF4	0.352	0.468	1.000	0.501	0.327
	CF5	0.320	0.541	0.501	1.000	0.446
	CF6	0.441	0.514	0.327	0.446	1.000
Sig. (1-tailed)	CF1		0.000	0.001	0.002	0.000
	CF2	0.000		0.000	0.000	0.000
	CF4	0.001	0.000		0.000	0.001
	CF5	0.002	0.000	0.000		0.000
	CF6	0.000	0.000	0.001	0.000	
Determinant = 0.255						

Running the principal component analysis (PCA), one factor with an eigenvalue of 2.723, explaining 54.456 % of variance, was extracted (refer to Table 4.6 below). This demonstrated that the scale items were measuring a common theme of customer focus and that they are related. This conclusion was supported by the scree plot in Figure 4.1 below which shows a single factor above the point of inflexion on the curve, i.e. the point where the curve begins to tail off towards a stable plateau. The fact that one factor was extracted is not unexpected, as the scale items were adopted from past research work (Prajogo & Sohal, 2006; Kim et al., 2012, Samson & Terziovski, 1999). No rotation was carried out since only one factor was extracted.

Table 4.6: Total variance explained for the customer focus scale

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.723	54.456	54.456	2.723	54.456	54.456
2	0.762	15.237	69.692			
3	0.635	12.708	82.401			
4	0.449	8.978	91.379			
5	0.431	8.621	100.000			
Extraction Method: Principal Component Analysis.						

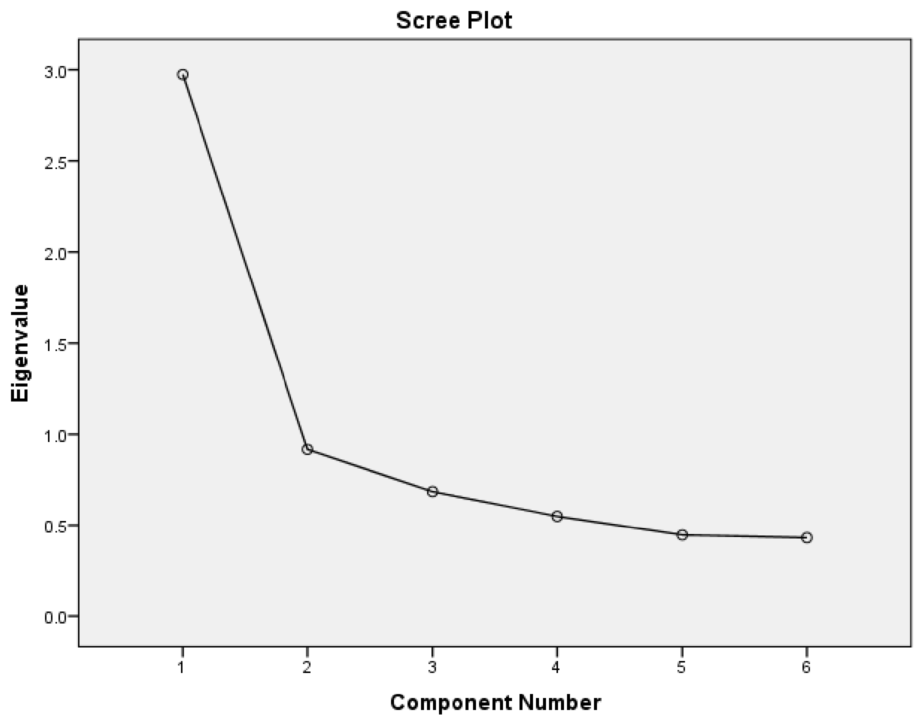

Figure 4:1: Scree plot for the customer focus scale

Table 4.7 below gives the factor loadings of the items on the factor extracted. A factor loading is a correlation between a specific observed variable and the extracted factor, with higher values indicating a close relationship. The higher the values are, the better the relationship is. The factor loadings obtained indicated good association between variable items and the latent variable of customer focus.

Table 4.7: Factor loading for the customer focus scale items

	Scale items	Factor Loadings
CF1	Needs and expectation of customers regularly sought.	0.652
CF2	Needs and expectations of customers are always communicated to employees.	0.799
CF4	Our customers freely communicate with us to maintain close relationship.	0.716
CF5	Customer complaints are resolved effectively.	0.772
CF6	Customer satisfaction is measured regularly.	0.741

4.3.2 Scale items relating to leadership

4.3.2.1 Descriptive analysis of results

Table 4.8: Frequencies for the scale items for the leadership construct

		Percentage (%) frequency of responses						
	Scale Items	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	disagree	Strongly disagree
LD1	Management encourages a culture of learning, improvement and change.	28.9	41.0	15.7	12.0	2.4	0	0
LD2	Leadership provides adequate resources for improvement of quality.	26.5	44.6	18.1	6.0	2.4	2.4	0
LD3	Individuals and/or departments are united by common purpose and no barriers exist.	9.6	45.8	24.1	12.0	6.0	1.2	1.2
LD4	Leadership participates in quality meetings and contribute with ideas.	24.1	48.2	21.7	3.6	2.4	0	0
LD5	All employees are encouraged to participate on improvement initiatives.	24.1	41.0	26.5	3.6	3.6	1.2	0
LD6	Our leaders also learn quality-related skills	19.3	49.4	18.1	8.4	2.4	2.4	0

As shown in Table 4.8 above, most participants responded positively by agreeing or strongly agreeing with the statements relating to leadership's role in total quality management, giving an average of 67.08 %. As with the customer focus construct, the results indicated the deep entrenchment of the leadership practice as an organisational management practice for TQM. The highest scores for the agree or strongly agree sentiment were obtained from item LD4 (Leadership participates in quality meetings and contribute with ideas), with a percentage of 72.3 %, followed by LD2 (Leadership provides adequate resources for improvement of quality) with 71.1 %, and LD1 (Management encourages a culture of learning, improvement and change) with 69.9 %. Such a high scoring may be attributed to the fact that most of the respondents were in management positions and therefore were positively biased towards such responses.

Table 4.9: Descriptive statistics for leadership construct

		Descriptive Statistics – leadership				
	Scale Items	Mean	Std Deviation	Mode	Skewness	Kurtosis
LD1	Management encourages a culture of learning, improvement and change.	5.82	1.061	6	-0.758	-0.125
LD2	Leadership provides adequate resources for improvement of quality.	5.80	1.124	6	-1.327	2.167
LD3	Individuals and/or departments are united by common purpose and no barriers exist.	5.33	1.190	6	-1.150	1.592
LD4	Leadership participates in quality meetings and contribute with ideas.	5.88	.903	6	-0.879	1.183
LD5	All employees are encouraged to participate on improvement initiatives.	5.75	1.057	6	-1.058	1.633
LD6	Our leaders also learn quality-related skills	5.67	1.106	6	-1.261	1.938
Composite Statistics		5.706	0.830	6	-0.948	0.347

The mean scores as presented in Table 4.9 are fairly uniform, indicating common assessment of the leadership construct. The standard deviations also follow the same pattern. The results are skewed to the high end of the scale, with skewness absolute values of slightly above one for some of the items. Both negative and positive kurtosis were obtained, but were below the +/- 3 cut-off limit and were therefore acceptable (Lee, 2016).

4.3.2.2 Reliability and construct validity

The reliability test for the leadership items was done using SPSS software and the results are presented in Table 4.10 below. The Cronbach's alpha score of 0.863 was obtained, surpassing the minimum of 0.7 (Hair et al., 2010), and hence confirming the reliability of the scale. There was no need to delete any item.

Table 4.10: Reliability tests results for the leadership construct

Scale Items	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation
LD1	0.836	0.683	-	-
LD2	0.858	0.564	-	-
LD3	0.847	0.631	-	-
LD4	0.841	0.666	-	-
LD5	0.818	0.781	-	-
LD6	0.842	0.648	-	-
Total Alpha	**0.863**			

4.3.2.3 Factor analysis for the items measuring leadership

Using the PCA, a test was done on the six items of the leadership scale to establish their validity. The suitability of the data for factor analysis was checked first by checking the correlation matrix presented in Table 4.11 below. All the correlation coefficients were found to be greater than the minimum acceptable of 0.3 with significant relationships. The determinant was 0.071 which is greater than the necessary value of 0.00001.

Table 4.11: Correlation Matric for items relating leadership construct

Correlation Matrix

		LD1	LD2	LD3	LD4	LD5	LD6
Correlation	LD1	1.000	0.460	0.453	0.601	0.600	0.573
	LD2	0.460	1.000	0.461	0.432	0.520	0.388
	LD3	0.453	0.461	1.000	0.502	0.589	0.489
	LD4	0.601	0.432	0.502	1.000	0.632	0.449
	LD5	0.600	0.520	0.589	.632	1.000	0.649
	LD6	0.573	0.388	0.489	0.449	0.649	1.000
Sig. (1-tailed)	LD1		0.000	0.000	0.000	0.000	0.000
	LD2	0.000		0.000	0.000	0.000	0.000
	LD3	0.000	0.000		0.000	0.000	0.000
	LD4	0.000	0.000	0.000		0.000	0.000
	LD5	0.000	0.000	0.000	0.000		0.000
	LD6	0.000	0.000	0.000	0.000	0.000	
Determinant = 0.071							

With the KMO value of 0.864, the Bartlett's test of sphericity of 209.24, and df of 15 and being significant at $p<0.001$, the sampling adequacy was confirmed to be adequate for factor analysis to be performed.

The PCA extracted one factor with an eigenvalue of 3.615 explaining 60.245 % of the variance, as depicted in Table 4.12 below. This one factor extracted was confirmed by the scree plot presented in Figure 4.2 below. Therefore, it was concluded that all the scale items used to measure the leadership construct do measure the common theme.

Table 4.12: Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.615	60.245	60.245	3.615	60.245	60.245
2	.643	10.721	70.966			
3	.563	9.383	80.348			
4	.531	8.854	89.203			
5	.375	6.251	95.454			
6	.273	4.546	100.000			
Extraction Method: Principal Component Analysis.						

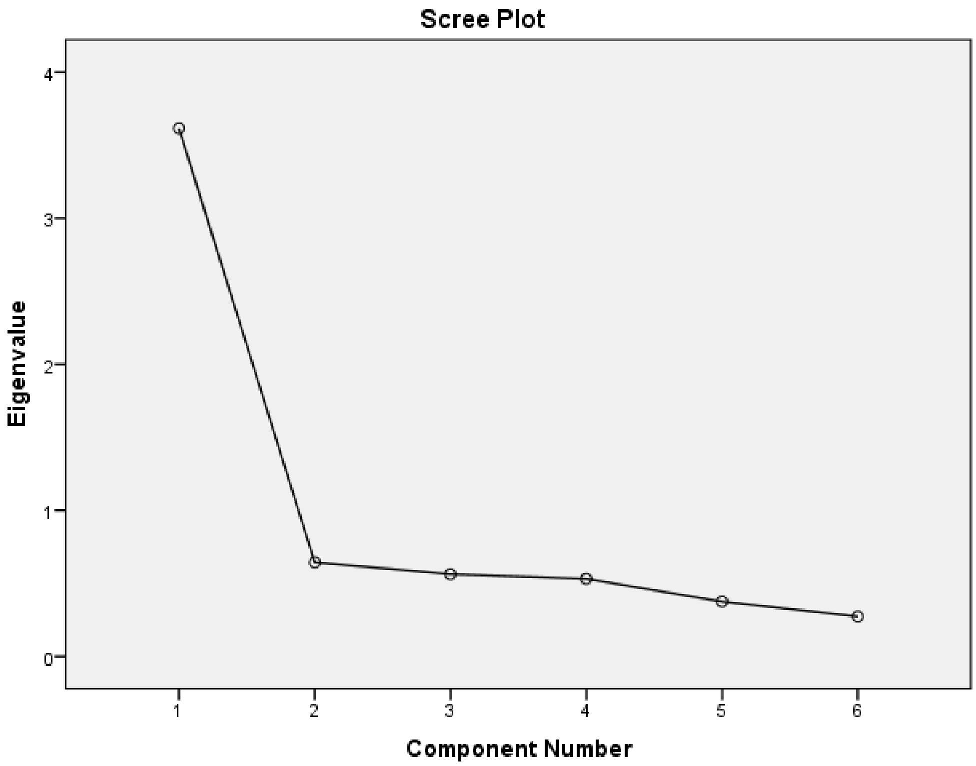

Figure 4:2: The Scree plot for leadership scale items

The factor loadings for the extracted factor were all above the critical value of 0.5 for all the items. This confirmed that the variables used all measured a common theme of leadership. These results are presented in Table 4.13 below.

Table 4.13: Factor loading results for the scale items pertaining to leadership

	Scale items	Factor Loadings
LD1	Management encourages a culture of learning, improvement and change.	0.797
LD2	Leadership provides adequate resources for improvement of quality.	0.687
LD3	Individuals and/or departments are united by common purpose and no barriers exist.	0.748
LD4	Leadership participates in quality meetings and contribute with ideas.	0.782
LD5	All employees are encouraged to participate on improvement initiatives.	0.867
LD6	Our leaders also learn quality-related skills	0.766

4.3.3 Scale items relating to people management

4.3.3.1 Descriptive analysis of results

In assessing the role of people management in total quality management, seven items were used, and about half of the respondents concurred by agreeing and strongly agreeing to the statements assessing whether this dimension is fairly ingrained within their organisational systems. The average percentage was found to be 49.74 % (see Table 4.14 below). The item with the highest agreement was PM3 (Our SHE (safety, health and environment) issues are a priority), with a percentage totalling 74.7 %. This item assesses the employees' working conditions, and considering that most of the respondents were from the management category, such a high endorsement is not unexpected. At the lower end were items PM6 and PM7, with less than 40 % agreeing and strongly agreeing. These items assess whether their firms' compensation encourages team and individual contributions and whether employee development plans are in place.

Table 4.14: Frequencies for the people management scale

		Percentage (%) frequency of responses						
	Scale Items	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	disagree	Strongly disagree
PM1	Employees communicate their ideas freely to management. and vice versa.	15.7	31.3	30.1	10.8	7.2	4.8	0
PM2	Feedback on employee satisfaction is regularly sought.	16.9	21.7	31.7	20.5	9.6	8.4	1.2
PM3	Our SHE (safety, health and environment) issues are a priority.	34.9	39.8	18.1	6.0	0	1.2	0
PM4	Quality is every employee's responsibility.	22.9	44.6	14.5	7.2	4.8	3.6	2.4
PM5	Compensation is linked to quality work.	14.5	27.7	22.9	18.1	4.8	9.6	2.4
PM6	Both individual and teamwork contributions are rewarded accordingly.	9.6	30.1	26.5	15.7	7.2	8.4	2.4
PM7	Training, learning and career path development are available for all employees.	8.4	30.1	22.9	18.1	9.6	8.4	2.4

As seen in Table 4.15 below, the mean scores for the people management items indicate a less convincing endorsement of this principle of total quality management within the organisations. The predominant assessment ranged from somewhat agreeing to agreeing, with standard deviations around 1.5, except for PM3 which had a standard deviation just under one, at 0.988. The high standard deviations explain the divergent assessments by different respondent categories of how the employees are managed in their organisations. The results show negative skewness. Items PM3 and PM4 show larger negative skewness and higher kurtosis values.

Table 4.15: The descriptive statistics of items pertaining to people management

		Descriptive Statistics – people management				
	Scale Items	Mean	Std Deviation	Mode	Skewness	Kurtosis
PM1	Employees communicate their ideas freely to management. and vice versa.	5.23	1.319	6	-0.730	0.098
PM2	Feedback on employee satisfaction is regularly sought.	4.86	1.563	5	-0.383	-0.655
PM3	Our SHE (safety, health and environment) issues are a priority.	6.00	.988	6	-1.167	2.125
PM4	Quality is every employee’s responsibility.	5.53	1.443	6	-1.422	1.722
PM5	Compensation is linked to quality work.	4.90	1.582	6	-0.671	-0.263
PM6	Both individual and teamwork contributions are rewarded accordingly.	4.84	1.510	6	-0.729	-0.115
PM7	Training, learning and career path development are available for all employees.	4.75	1.521	6	-0.603	-0.381
Composite Statistics		5.17	1.076	6	-0.607	-0.357

4.3.3.2 Reliability and construct validity

As illustrated in Table 4.16 below, the reliability of the scale items pertaining to People Management was determined by calculating the Cronbach’s alpha score, which was found to be 0.883, surpassing the minimum of 0.7 (Hair et al., 2010). Therefore, the scale was deemed reliable and there was no need to delete any item. This means that the scale will give similar results if the test were to be repeated (Hair et al., 2010). The corrected item-total correlation values for all the items were all above 0.5.

Table 4.16: Reliability results for items pertaining to people management

Scale Items	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation
PM1	0.863	0.700	-	-
PM2	0.866	0.677	-	-
PM3	0.885	0.509	-	-
PM4	0.872	0.627	-	-
PM5	0.853	0.768	-	-
PM6	0.858	0.733	-	-
PM7	0.863	0.701	-	-
Total Alpha	**0.883**			

4.3.3.3 Factor Analysis for items relating to people management

The item-item correlation matrix for the people management scale items is presented in Table 4.17. As illustrated in the table, all the correlation values were found to be above 0.3, indicating some association between these items. The determinant was found to be above 0.00001, at 0.023. Therefore, a valid factor analysis could be performed on the data.

Table 4.17: Correlation matrix for scale items relating to people management

Correlation Matrix								
		PM1	PM2	PM3	PM4	PM5	PM6	PM7
Correlation	PM1	1.000	0.561	0.403	0.640	0.630	0.514	0.473
	PM2	0.561	1.000	0.371	0.343	0.547	0.667	0.626
	PM3	0.403	0.371	1.000	0.394	0.421	0.319	0.528
	PM4	0.640	0.343	0.394	1.000	0.600	0.475	0.501
	PM5	0.630	0.547	0.421	0.600	1.000	0.739	0.547
	PM6	0.514	0.667	0.319	0.475	0.739	1.000	0.577
	PM7	0.473	0.626	0.528	0.501	0.547	0.577	1.000
Sig. (1-tailed)	PM1		0.000	0.000	0.000	0.000	0.000	0.000
	PM2	0.000		0.000	0.001	0.000	0.000	0.000
	PM3	0.000	0.000		0.000	0.000	0.002	0.000
	PM4	0.000	0.001	0.000		0.000	0.000	0.000
	PM5	0.000	0.000	0.000	0.000		0.000	0.000
	PM6	0.000	0.000	0.002	0.000	0.000		0.000
	PM7	0.000	0.000	0.000	0.000	0.000	0.000	
Determinant = 0.023								

The Bartlett's test for sphericity was found to have a chi-square value of 198.670, df = 15 which was significant at p value of less than 0.001. With the KMO value of 0.817, these results indicated that the sample was adequate for conducting factor analysis on the data.

PCA revealed that only one factor was extracted with an eigenvalue of 4.136, and explained a variance of 59.081 % of the data. These results are presented in Table 4.18 below. Examining the scree plot in Figure 4.3 below, the graph also confirms the fact that only one factor could be extracted before the point of inflexion.

Table 4.18: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.136	59.081	59.081	4.136	59.081	59.081
2	0.786	11.232	70.314			
3	0.753	10.762	81.075			
4	0.464	6.631	87.706			
5	0.424	6.050	93.757			
6	0.246	3.517	97.273			
7	0.191	2.727	100.000			
Extraction Method: Principal Component Analysis.						

The factor loadings for the people management items on the extracted factor are presented in Table 4.19 below. All the factor loadings are adequate, surpassing the minimum of 0.5.

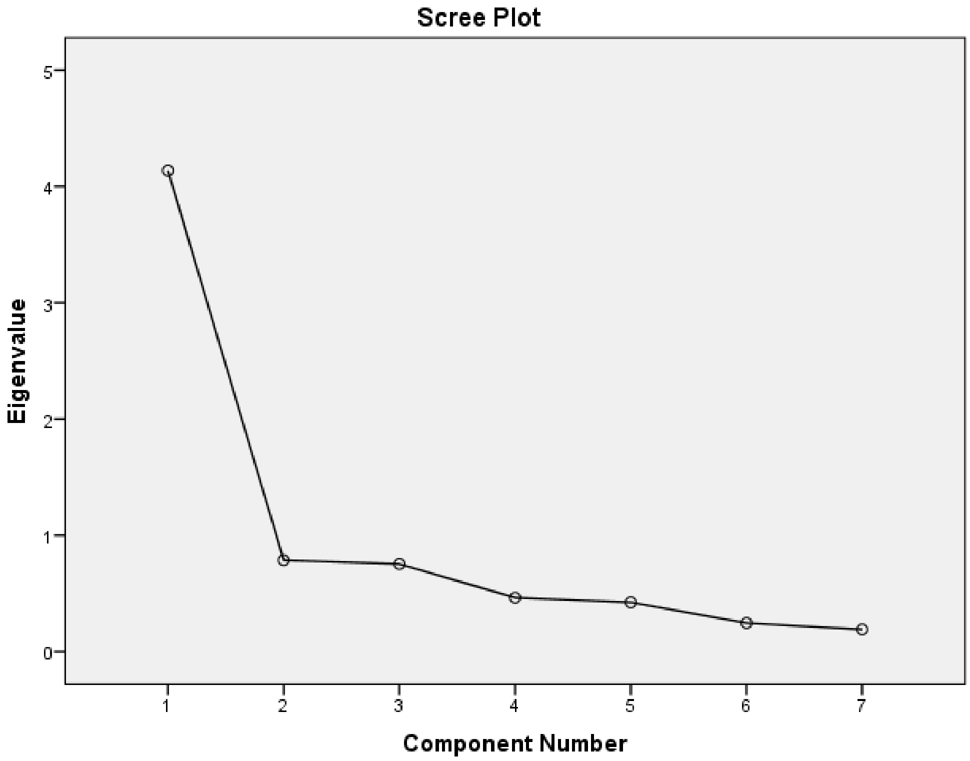

Figure 4:3: Scree plot for items relating to people management

Table 4.19: Factor loadings scores for the people management items

	Scale items	Factor Loadings
PM1	Employees communicate their ideas freely to management. And vice versa.	0.789
PM2	Feedback on employee satisfaction is regularly sought.	0.772
PM3	Our SHE (safety, health and environment) issues are a priority.	0.614
PM4	Quality is every employee’s responsibility.	0.734
PM5	Compensation is linked to quality work.	0.846
PM6	Both individual and teamwork contributions are rewarded accordingly.	0.812
PM7	Training, learning and career path development are available for all employees.	0.791

4.3.4 Scale items relating to product innovation

4.3.4.1 Descriptive analysis of results.

Table 4.20: Frequencies for the scale items pertaining to product innovation

		Percentage (%) frequency of responses						
	Scale Items	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	disagree	Strongly disagree
Prod1	Our company is always ahead of competitors in producing new products (new product introduction in the market).	13.3	27.7	33.7	16.9	4.8	2.4	1.2
Prod2	The new products produced by our firm significantly differ from our existing products. The level of newness is high.	9.6	24.1	36.1	20.5	6.0	1.2	2.4
Prod3	Our firm has introduced a number of new products to the market in the last 3 years.	9.6	36.1	22.9	22.9	6.0	1.2	1.2
Prod4	When introducing new products, our firm does so in the shortest possible time compared to others in the industry.	10.8	25.3	26.5	27.7	4.8	3.6	1.2

There were four items used to measure product innovation, and the frequencies of responses are presented in Table 4.20 above. Compared with the TQM constructs, these results show that, on average, the respondents answered between agree and somewhat agree as the dominant responses. The item Prod1 (Our company is always ahead of competition in producing new products) has the highest mean value, whereas the item Prod4 (When introducing new products, our firm does so in the shortest possible time compared to others in the industry) has the lowest mean of 4.94 (see Table 4.21 below). The skewness of the results was found to be slightly negative and ranged from -0.465 to -0.722. This also applies to the kurtosis, which was found to be positive and below 1, except for item Prod2.

Table 4.21: Descriptive statistics for items pertaining to product innovation

		Descriptive Statistics – product innovation				
	Scale Items	Mean	Std Deviation	Mode	Skewness	Kurtosis
Prod1	Our company is always ahead of competitors in producing new products (new product introduction in the market).	5.16	1.254	5	-0.722	0.851
Prod2	The new products produced by our firm significantly differ from our existing products. The level of newness is high.	4.98	1.259	5	-0.743	1.203
Prod3	Our firm has introduced a number of new products to the market in the last 3 years.	5.12	1.234	6	-0.674	0.467
Prod4	When introducing new products, our firm does so in the shortest possible time compared to others in the industry.	4.94	1.301	4	-0.465	0.227
Composite Statistics		5.05	0.999	5	-0.801	2.399

4.3.4.1 Reliability and construct validity

The Cronbach's alpha for the scale items measuring product innovation was found to be 0.802, indicting good reliability of the scale as this value is higher than the minimum of 0.7. These results are presented in Table 4.22. This means that the scale will give similar results if the test were to be repeated. The corrected item-total correlation values for each item were also found to be above 0.5. The scale was therefore deemed reliable.

Table 4.22: Cronbach's alpha scores for items pertaining to product innovation

Scale Items	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation
Prod1	0.754	0.612	-	-
Prod2	0.755	0.610	**-**	-
Prod3	0.743	0.636	**-**	-
Prod4	0.758	0.604	**-**	-
Total Alpha	**0.802**		**-**	-

4.3.4.2 Factor Analysis for items relating to product innovation

Table 4.23: Correlation matrix for items pertaining to product innovation

Correlation Matrix					
		ProdI1	ProdI2	ProdI3	ProdI4
Correlation	ProdI1	1.000	0.497	0.484	0.522
	ProdI2	0.497	1.000	0.552	0.453
	ProdI3	0.484	0.552	1.000	0.514
	ProdI4	0.522	0.453	0.514	1.000
Sig. (1-tailed)	ProdI1		0.000	0.000	0.000
	ProdI2	0.000		0.000	0.000
	ProdI3	0.000	0.000		0.000
	ProdI4	0.000	0.000	.000	
Determinant = 0.301					

Examining the correlation matrix of the four items relating to product innovation revealed that the correlations were significant at $p<0.001$, with all the values being above 0.3. The determinant was also found to be greater than 0.00001, signifying that the scale data can be used for factor analysis.

By testing for sample adequacy for factor analysis using the Bartlett's test of sphericity, the values of approx. chi-square = 95.982, df = 6 and significant at $p<0.001$ were obtained. The KMO value was found to be 0.787, surpassing the 0.6 limit. It was therefore concluded that the sample is adequate for factor analysis.

Using PCA, one factor was extracted with an eigenvalue of 2.511, accounting for 62.778 % of variance (refer to Table 4.24 below). No other significant factor was extracted. This was confirmed by examining the scree plot presented in Figure 4.4 below.

Table 4.24: Factors extracted

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.511	62.778	62.778	2.511	62.778	62.778
2	.566	14.154	76.932			
3	.500	12.497	89.429			
4	.423	10.571	100.000			

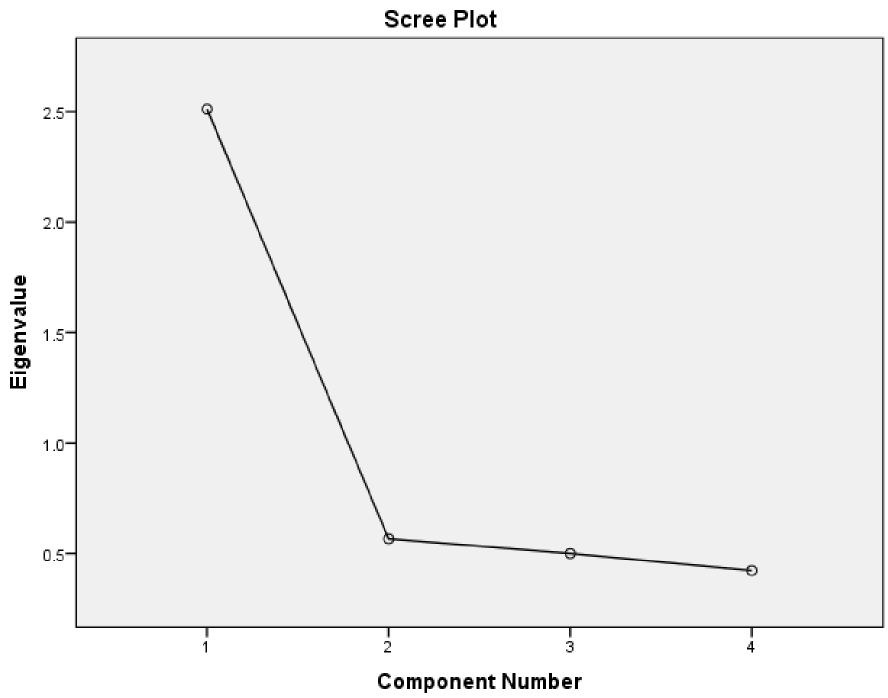

Figure 4:4: Scree plot for items pertaining to product innovation

Table 4.25: Factor loadings for items pertaining to product innovation

	Scale items	Factor Loadings
Prod1	Our company is always ahead of competitors in producing new products (new product introduction in the market).	0.789
Prod2	The new products produced by our firm significantly differ from our existing products. The level of newness is high.	0.789
Prod3	Our firm has introduced a number of new products to the market in the last 3 years.	0.807
Prod4	When introducing new products, our firm does so in the shortest possible time compared to others in the industry.	0.784

All the items used for product innovation loaded to the same factor, as illustrated in Table 4.25 above. This confirms that the variables used all measured the same latent variable of product innovation.

4.3.5 Scale items relating to process innovation

4.3.5.1 Descriptive analysis of results

The results in Table 4.26 below present the percentage frequencies of responses for items pertaining to process innovation and it can be seen that the predominant scores were between agree and somewhat agree, except for item Proc3 (Our firm has introduced new or significantly improved machinery and/or equipment for producing products), where a significant number of respondents took a neutral position.

Table 4.26: Frequencies for items pertaining to process innovation

		Percentage (%) frequency of responses						
	Scale Items	Strongly agree	Agree	Somewhat agree	Neither agree or disagree	Somewhat disagree	Disagree	Strongly disagree
Proc1	Significantly modified equipment or new equipment is used to produce products.	12.0	30.1	28.9	13.3	7.2	8.4	0
Proc2	New or significantly modified production methods are being used to produce products.	8.4	31.3	27.7	18.1	3.6	10.8	0
Proc3	Our processes are the most up-to-date and novel in our industry	9.6	16.9	25.3	24.1	4.8	15.7	3.6
Proc4	Our firm quickly change its processes, techniques and technology faster than competition when required	10.8	19.3	25.3	22.9	4.8	14.5	2.4

The mean scores range between somewhat agree and neither agree or disagree, as shown in Table 4.27 below. The standard deviations range from 1.4 to 1.6, while the data is slightly negatively skewed. Negative kurtosis was also found. The high standard deviations obtained indicate the divergent views among the respondents.

Table 4.27: Descriptive statistics for product innovation

		Descriptive Statistics – Product Innovation				
	Scale Items	Mean	Std Deviation		Skewness	Kurtosis
Proc1	Significantly modified equipment or new equipment is used to produce products.	5.01	1.410	6	-0.664	-0.237
Proc2	New or significantly modified production methods are being used to produce products.	4.90	1.402	6	-0.695	-0.188
Proc3	Our processes are the most up-to-date and novel in our industry	4.41	1.631	5	-0.328	-0.678
Proc4	Our firm quickly change its processes, techniques and technology faster than competition when required	4.55	1.602	5	-0.383	-0.629
	Composite Statistics	4.72	1.227	6	-0.708	-0.119

4.3.5.2 Reliability and construct validity

The technique of evaluating the Cronbach's alpha score was used to test the reliability of the scale and it was found that the alpha for this set of items was 0.826, which is above the minimum acceptable value of 0.7. These results are presented in Table 4.28 below. It is therefore concluded that the scale is reliable and that the scale will give similar results if the test were to be repeated. In addition, the corrected item-total correlation for each item was found to be above 0.5. All the items were retained for further analysis.

Table 4.28: Reliability results for items relating to process innovation

Scale Items	Cronbach's Alpha if Item Deleted	Corrected Item-Total Correlation	Adjusted Cronbach's Alpha	Corrected Item-Total Correlation
Proc1	0.838	0.513		
Proc2	0.740	0.746		
Proc3	0.784	0.645	-	
Proc4	0.748	0.717		
Total Alpha	**0.826**			

4.3.5.3 Factor Analysis of items pertaining to process innovation

Table 4.29 below presents the correlation matrix for items pertaining to process innovation and all the correlations were found to be above a minimum of 0.3, therefore providing initial evidence of their association. The determinant of 0.200 confirmed that the sample data was sufficient for factor analysis.

Therefore, based on these results, principal factor analysis was conducted to extract the factors. The results of the principal component analysis are presented in Table 4.30 below.

Table 4.29: Correlation matrix for items pertaining to process innovation

Correlation Matrix					
		ProcI1	ProcI2	ProcI3	ProcI4
Correlation	ProcI1	1.000	0.562	0.369	0.424
	ProcI2	0.562	1.000	0.583	0.670
	ProcI3	0.369	0.583	1.000	0.654
	ProcI4	0.424	0.670	0.654	1.000
Sig. (1-tailed)	ProcI1		0.000	0.000	0.000
	ProcI2	0.000		0.000	0.000
	ProcI3	0.000	0.000		0.000
	ProcI4	0.000	0.000	0.000	
Determinant = 0.200					

Table 4.30: Factors extracted

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.645	66.137	66.137	2.645	66.137	66.137
2	0.686	17.156	83.293			
3	0.372	9.308	92.601			
4	0.296	7.399	100.000			
Extraction Method: Principal Component Analysis.						

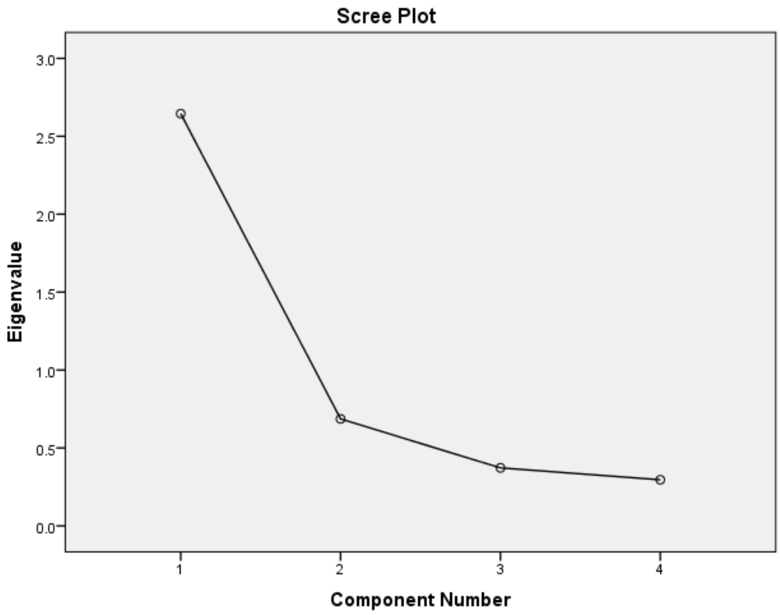

Figure 4:5: The scree plot for items pertaining to process innovation

According to Table 4.30 above and the scree plot presented in Figure 4.5 above, it was revealed that only one factor was extracted with an eigenvalue above 1.0 and explained 66.1 % of variance in the data. Therefore, all the items used were found to belong to one theme and measured all process innovation as intended. The factor loadings presented in Table 4.32 below also indicated that all the items load to the same factor, with all the values being greater than the minimum of 0.5.

Table 4.31: The factor loadings for the process innovation extracted factor

	Scale items	Factor Loadings
Proc1	Significantly modified equipment or new equipment is used to produce products.	0.701
Proc2	New or significantly modified production methods are being used to produce products.	0.875
Proc3	Our processes are the most up-to-date and novel in our industry	0.808
Proc4	Our firm quickly change its processes, techniques and technology faster than competition when required	0.858

A summary of the evaluation done on the instrument to test its suitability for data collection in this study is shown in Table 4.33 below. The results show that the instrument is capable of giving credible results.

Table 4.32: Summary of Measurement Instrument Evaluation

Construct	Item	mean	Cronbach's alpha	Factor Loadings	% Variance
Customer Focus	CF1	6.17	0.782	0.652	54.5
	CF2	5.93		0.799	
	CF4	6.31		0.716	
	CF5	6.08		0.772	
	CF6	5.57		0.741	
Leadership	LD1	5.82	0.863	0.797	60.3
	LD2	5.80		0.687	
	LD3	5.33		0.748	
	LD4	5.88		0.782	
	LD5	5.75		0.857	
	LD6	5.67		0.766	
People Management	PM1	5.23	0.883	0.789	59.1
	PM2	4.86		0.772	
	PM3	6.00		0.614	
	PM4	5.53		0.734	
	PM5	4.90		0.846	
	PM6	4.84		0.812	
	PM7	4.75		0.791	
Product Innovation	Prod1	5.16	0.802	0.789	62.8
	Prod2	4.98		0.789	
	Prod3	5.12		0.807	
	Prod4	4.94		0.784	
Process Innovation	Proc1	5.01	0.826	0.701	66.1
	Proc2	4.90		0.875	
	Proc3	4.41		0.808	
	Proc4	4.55		0.858	

The Pearson's correlations of the TQM dimensions, as shown in Table 4.33 below, were found to be statistically significant at $p < 0.01$ or better and were all positive, signifying the holistic nature of TQM. This means that they are complementary to one another and must be applied as a whole. The correlation of product innovation and process innovation was found to be 0.283 at $p <0.01$ signifying a moderately reinforcing nature of these forms of innovation. All the three TQM dimensions were found to be correlated, with product innovation at $p < 0.05$, while only people management was significantly correlated to process innovation.

Table 4.33: Pearson's correlations of the forms of innovation and the TQM dimensions

Correlations						
		Product innovation	Process innovation	Customer focus	Leadership	People management
Product innovation	Pearson Correlation	1	.283**	.219*	.290**	.262*
	Sig. (2-tailed)		.010	.046	.008	.017
Process innovation	Pearson Correlation	.283**	1	.147	.154	.288**
	Sig. (2-tailed)	.010		.184	.164	.008
Customer focus	Pearson Correlation	.219*	.147	1	.671**	.617**
	Sig. (2-tailed)	.046	.184		.000	.000
Leadership	Pearson Correlation	.290**	.154	.671**	1	.757**
	Sig. (2-tailed)	.008	.164	.000		.000
People management	Pearson Correlation	.262*	.288**	.617**	.757**	1
	Sig. (2-tailed)	.017	.008	.000	.000	
** Correlation is significant at the 0.01 level (2-tailed)						
* Correlation is significant at the 0.05 level (2-tailed)						

4.4 Hypothesis Testing

In order to test the conceptual model developed in Chapter Two, multiple regression analysis (MRA) was used to predict the relationships between TQM dimensions as independent variables, and product or process innovation as the dependent variable. This is because multiple regression is a practical statistical tool that can be used to investigate the association between a set of predictor variables with one outcome variable (Hair et al., 2010).

Six distinct multiple regression analyses were run to test the six hypotheses put forward in this study. These are for customer focus and product innovation; customer focus and process innovation; leadership and product innovation; leadership and process innovation; people management and product innovation; and finally, people management and process innovation relationships. In all these MRAs, the firm size (named size) and the time span since firm's quality certification with an appropriate certification body (named certification) were used as the control variables in in first step of the hierarchal regression analysis, while each of the independent variables – customer focus, leadership or people management – was used in the second step in testing the respective hypothesis. The firm size was coded as follows:

- 0 – 49 = 1; 50 – 200 = 2; 200 – 500 = 3; and over 500 = 4, while the periods of certification were coded as
- Less than 1 year = 1; 2 to 5 years = 2; 6 to 10 years = 3; and over 10 years = 4.

The model fit for the regression analysis was determined by the F-statistics. The coefficient of determination R^2 which was obtained after running a regression analysis was used to explain the total variance in the outcome variable accounted for by the predictor variable(s). The 90 % or 95 %, or 99 % confidence levels used to support the hypothesis were possible.

According to a formula presented by Zikmund et al. (2010) of $N > 50 + 8 * m$, and with $m = 3$ since there were 3 independent variables used, the minimum sample size for multiple regression was calculated to be 74. Therefore, as 83 respondents were obtained in this study, the sample was deemed adequate for regression analysis to be used to test the hypotheses.

4.4.1 Testing for hypothesis H_1

To recap, the hypothesis H1 was stated as:

H_1 (alternate): TQM dimension of customer focus has a positive relationship with product innovation.

H_o (null): There is no positive relationship between customer focus and product innovation.

Table 4.34: Pearson's correlations for hypothesis H_1 variables

Correlations					
		Product innovation	Size	Certification	Customer focus.
Pearson Correlation	Product innovation	1.000	.011	-.014	.219
	Size	.011	1.000	.395	-.059
	Certification	-.014	.395	1.000	-.052
	Customer focus	.219	-.059	-.052	1.000
Sig. (1-tailed)	Product innovation	.	.462	.451	.023
	Size	.462	.	.000	.299
	Cert	.451	.000	.	.321
	Customer focus	.023	.299	.321	.

According to Table 4.34 above, there is a fairly moderate correlation (r = 0.219) between the TQM dimension of customer focus and product innovation, giving initial evidence of a positive relationship of the customer focus variable with the product innovation. This association is significant at $p < 0.05$. (i.e. $p = 0.023$). This gives initial support for hypothesis H_1. The association between certification and product innovation was found to be negative and very weak, while that for size and product innovation is also very weak.

In order to validate the regression analysis, multicollinearity and normality of the data was checked for in the data. Hair et al. (2010) suggested that if the correlation value does not exceed 0.90, then multicollinearity does not exist. In this study, there is no correlation value that is above 0.90, therefore multicollinearity is not a problem. Furthermore, the tolerance and the variance inflation factors (VIFs) were also checked to assess multicollinearity problems. Multicollinearity exist when tolerance values of less than 0.1 and VIF values of greater than 10 are obtained. This was not the case, as shown in Table 4.34, hence no collinearity issues were found. The histogram and P-P plot presented in Figure 4.6 below indicated reasonable normality of data, which is another condition to be met for valid regression analysis.

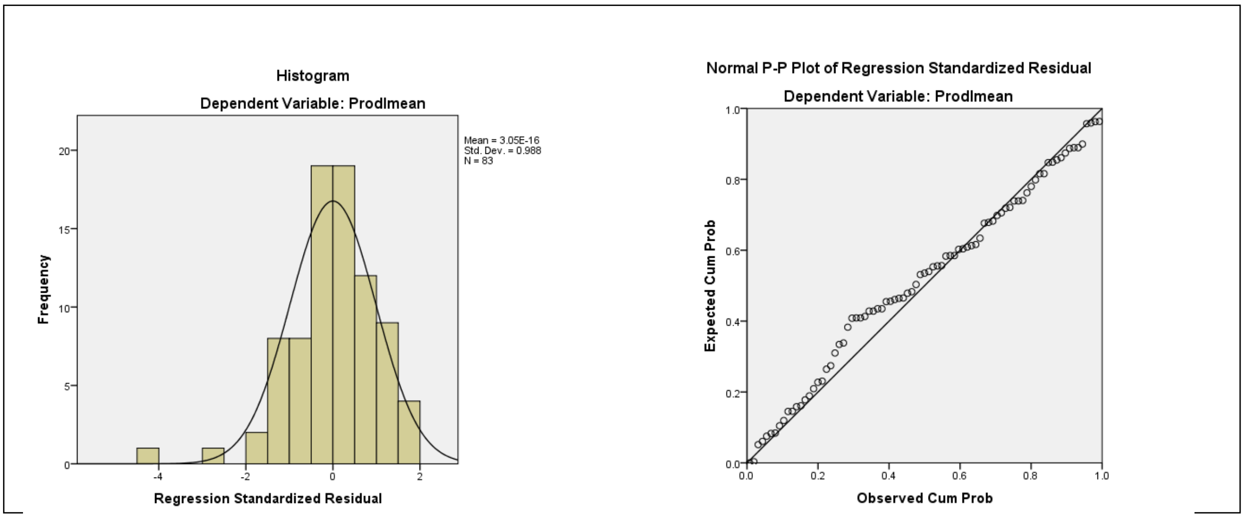

Figure 4.6: Histogram and P-P plot for Hypothesis H1.

Table 4.35: The Anova results

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.040	2	.020	.020	.981[b]
	Residual	81.892	80	1.024		
	Total	81.932	82			
2	Regression	4.000	3	1.333	1.352	.264[c]
	Residual	77.932	79	.986		
	Total	81.932	82			

From Table 4.35 above, it was observed that the regression model 1 was not significant and therefore the firm size and certification will have no effect on product innovation. Surprisingly, it was also found that the regression model for step two was also not statistically significant (i.e. $p = 0.264$). This could be attributed to the influence of certification and firm size variables which were included in this second model. The R^2 for model and the coefficient of regression values were found to be significant at $p < 0.05$ (i.e. $p = 0.049$) as shown in Tables 4.36 and 4.37 below.

According to the regression analysis results (Table 4.36), firm size and certification explained 0 % variance in product innovation, as the relationship between these independent variables and product innovation is not statistically significant. The Pearson's correlation values presented in Table 4.34 above supported this finding. The coefficient of determination (R^2) for customer focus with product innovation was found to be 0.049, with the coefficient of regression of 0.327 at $p < 0.05$ (see Table 4.36). This implies that customer focus explained 4.9 % of variance in product innovation, and therefore hypothesis H_1

is accepted; i.e. customer focus has a positive relationship with product innovation. The coefficients of regression results are presented in Table 4.37 below. With a p value = 0.909 and 0.810 for certification and firm size, it was established that for the 90 % confidence level, certification and firm size do not have any significant association with product innovation.

Table 4.36: Regression model summary for hypothesis H1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.022[a]	.000	-.024	1.01176	.000	.020	2	80	.981
2	.221[b]	.049	.013	.99322	.048	4.015	1	79	.049

a. Predictors: (Constant), firm size, firm size, certification, b. Predictors: (Constant), Customer focus, Certification. c. Dependent Variable: Product Innovation.

Table 4.37: Coefficient of regression for customer focus and product innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.054	.378		13.383	.000	4.302	5.805		
	Size	.025	.158	.019	.155	.877	-.290	.340	.844	1.185
	Certification	-.018	.106	-.021	-.174	.862	-.230	.193	.844	1.185
2	(Constant)	3.039	1.072		2.837	.006	.907	5.172		
	Size	.038	.156	.029	.241	.810	-.272	.347	.843	1.187
	Certification	-.012	.104	-.014	-.115	.909	-.220	.196	.843	1.186
	Customer focus	.327	.163	.220	2.004	.049	.002	.652	.996	1.004

4.4.2 Testing of hypothesis H2

As discussed in Chapter Two, hypothesis H_2 was proposed as:

H_2 (alternate): TQM dimension of customer focus has a positive relationship with process innovation.

Ho (null): There is no positive relationship between customer focus and process innovation.

Table 4.38: Person's correlations for hypothesis H2 variables

Correlations					
		Process innovation	Size	Certification	Customer focus.
Pearson Correlation	Process innovation	1.000	-.081	-.246	.147
	Size	-.081	1.000	.395	-.059
	Certification	-.246	.395	1.000	-.052
	Customer focus	.147	-.059	-.052	1.000
Sig. (1-tailed)	Product innovation	.	.232	.013	.092
	Size	.232	.	.000	.299
	Cert	.013	.000	.	.321
	Customer focus	.092	.299	.321	.

The Pearson's correlation value between customer focus and process innovation was found not very strong ($r = 0.147$) and was statistically significant at $p < 0.1$ as presented in Table 4.37 above. Nevertheless, it signified the positive relation between these two variables. Firm size was found to be negatively and weakly correlated to process innovation, but this association was meaningless as it was not statistically significant. Certification was found to be negatively associated with process innovation at $p < 0.05$ (see Table 4.37).

Again, none of the correlations was above 0.90, hence multicollinearity was not a problem in this regression analysis. This was supported by an inspection of the tolerance values and VIFs values, which were within acceptable ranges as presented in Table 4.36. Figure 4.2 also indicated that the data was roughly close to normality, so as to substantiate reasonable regression analysis results.

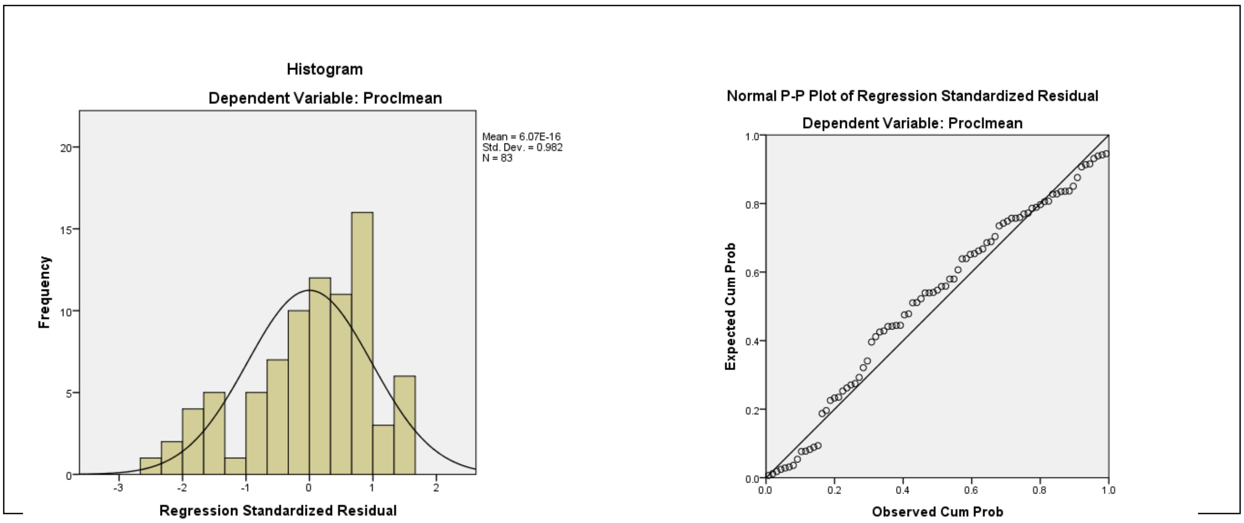

Figure 4:7: Histogram and P-P plots for data pertaining to hypothesis H2

In Table 4.39 below, the Anova test results are presented. Both the first step (F = 2.852 and p = 0.082) and the second step (F = 2.260 and p = 0.088) were found to be statistically significant at p < 0.1 level. Therefore, the regression model is a reasonable fit of the data and valid results were obtained.

Table 4.39: The Anova Results

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.492	2	3.746	2.582	.082[b]
	Residual	116.058	80	1.451		

	Total	123.550	82			
2	Regression	9.764	3	3.255	2.260	.088[c]
	Residual	113.786	79	1.440		
	Total	123.550	82			

In Table 4.40 below, the regression results for the relationship between customer focus and process innovation are presented. The R^2 for the first step of the regression analysis was 0.061, implying that firm size and time span since the firms acquired certification with a quality certifying body accounted for 6.41 % of variance in process innovation. The results are statistically significant at $p < 0.1$.

Table 4.40: Regression model summary for hypothesis H2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.246[a]	.061	.037	1.20446	.061	2.582	2	80	.082
2	.281[b]	.079	.044	1.20014	.018	1.577	1	79	.213

a. Predictors: (Constant), certification, firm size,

b. Predictors: (Constant), firm size, Certification. Customer focus

c. Dependent Variable: Process Innovation.

Table 4.41: Coefficient of regression for customer focus and process innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.491	.450		12.215	.000	4.596	6.386		
	Size	.030	.188	.019	.157	.875	-.345	.405	.844	1.185
	Certification	-.271	.126	-.253	-2.145	.035	-.523	-.020	.844	1.185
2	(Constant)	3.965	1.295		3.063	.003	1.388	6.542		
	Size	.039	.188	.025	.210	.834	-.335	.414	.843	1.187
	Certification	-.266	.126	-.248	-2.112	.038	-.517	-.015	.843	1.186
	Customer focus	.248	.197	.136	1.256	.213	-.145	.641	.996	1.004

The time span since a firm had acquired certification was found to be negatively related to process innovation, with the coefficient of regression value of -0.255 at a statistical significance level of $p < 0.05$. This implies that such certification of a quality management system hinders process innovation. This could be attributed to the requirements of the certification process that demand that all the processes must be documented in procedures which have to be adhered to each time that the process or task is performed. This limits experimentation, which is crucial in successful innovation processes.

With a coefficient of 0.248 and a p value of 0.213 for 90 % confidence level, customer focus was found not to be statistically related to process innovation. Therefore, hypothesis H_2 was not supported and was rejected. In other words, customer focus is not positively related to process innovation.

4.4.3 Testing of hypothesis H_3

The proposition for hypothesis H_3 was captured as:

H_3 (alternate): TQM dimension of leadership has a positive relationship with product innovation.

Ho (null): There is no positive relationship between leadership and product innovation.

A statistically significant Pearson correlation of 0.290 between leadership and product innovation was found (p =0.004), giving initial evidence of the association between the two variables (refer to Table 4.42 below). As mentioned for hypotheses 1, there is a weak correlation between certification and product innovation, as well as with firm size and product innovation. The correlation values are well below the cut-off of 0.9, therefore no problems of multicollinearity were encountered.

The data used to test hypothesis H_3 was deemed normal, as exemplified by the histogram and the P-P plots presented in Figure 4.8 below. Therefore, valid regression results were expected.

Table 4.42: Pearson's correlations for hypothesis H3 variables

Correlations					
		Product innovation	Size	Certification	Leadership
Pearson Correlation	Product innovation	1.000	.011	-.014	.290
	Size	.011	1.000	.395	.014
	Certification	-.014	.395	1.000	-.069
	Leadership	.290	.014	-.069	1.000
Sig. (1-tailed)	Product innovation	.	.462	.451	.004

	Size	.462	.	.000	.452
	Cert	.451	.000	.	.267
	Leadership	.004	.452	.267	.

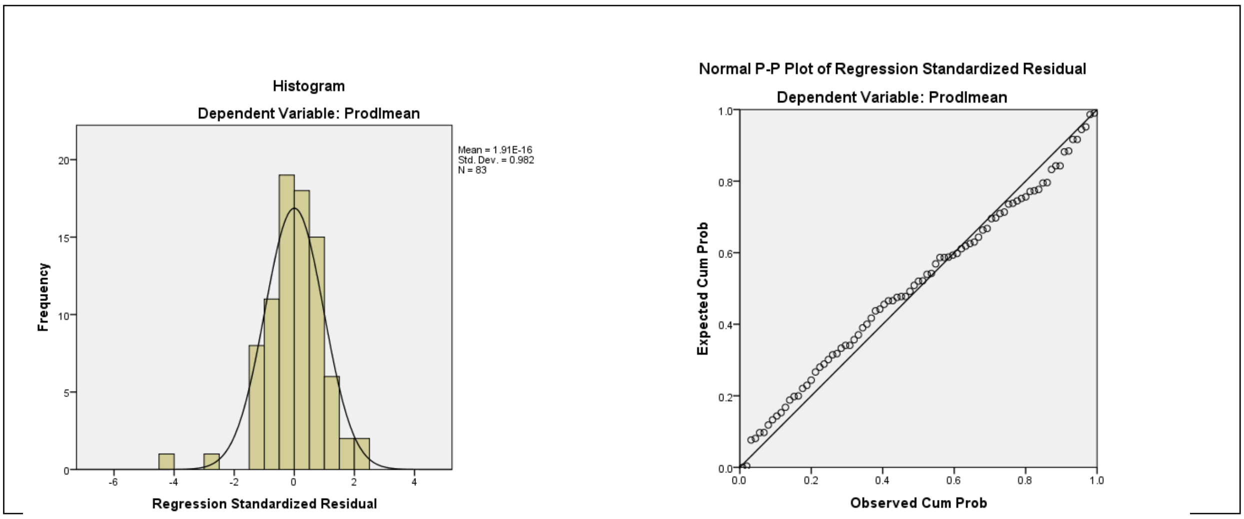

Figure 4:8: Histogram and P-P plots for data pertaining to hypothesis H3

Table 4.43: The Anova results – Hypothesis H3

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.040	2	.020	.020	.981[b]
	Residual	81.892	80	1.024		
	Total	81.932	82			
2	Regression	6.873	3	2.291	2.411	.073[c]
	Residual	75.059	79	.950		
	Total	81.932	82			

According to Table 4.43, the control variables for firm size and time span since certification used in model 1 were found not to have any effect on product innovation ($F = 0.020$, $p = 0.981$). The regression model for step one was found not to be statistically significant, and therefore was not different from zero. However, the regression model for step two in the hierarchal regression analysis was found to be statistically significant at $p < 0.1$. The F-statistics for the second regression step was $F = 2.411$ and $p = 0.073$.

As depicted in Table 4.44, leadership was found to have a coefficient of determination (R^2) of 0.084 with respect to product innovation, implying that 8.4 % of variance in product innovation is explained by leadership. Certification period and firm size played no role in product innovation. Therefore, hypothesis H_3 was accepted and it was inferred that leadership is positively related to product innovation in the South African Foundry industry.

Table 4.44: Regression model summary for hypothesis H3

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.022[a]	.000	-.024	1.01176	.000	.020	2	80	.981
2	.290[b]	.084	.049	.97474	.083	7.191	1	79	.009

a. Predictors: (Constant), firm size, certification

b. Predictors: (Constant), firm size, Certification, leadership.

c. Dependent Variable: Product Innovation.

Table 4.45: Coefficient of regression for customer focus and process innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.054	.378		13.383	.000	4.302	5.805		
	Size	.025	.158	.019	.155	.877	-.290	.340	.844	1.185
	Certification	-.018	.106	-.021	-.174	.862	-.230	.193	.844	1.185
2	(Constant)	3.033	.837		3.624	.001	1.367	4.698		
	Size	.006	.153	.005	.041	.967	-.298	.310	.842	1.187
	Certification	.004	.103	.004	.038	.970	-.200	.208	.838	1.193
	Leadership	.349	.130	.290	2.682	.009	.090	.608	.993	1.007

The beta coefficient of regression was found to be 0.349 and was statistically significant at p value of $p < 0.01$. These results are presented in Table 4.45 above. This implies that leadership is positively related to product innovation, and hence hypothesis H_3 is supported.

4.4.4 Testing for hypothesis H_4

Hypothesis H4 was stated as:

H_4 (alternate): TQM dimension of leadership has a positive relationship with process innovation.

Ho (null): There is no positive relationship between leadership and process innovation.

Table 4.46: Pearson's correlations for hypothesis H4 variables

Correlations					
		Process innovation	Size	Certification	Leadership.
Pearson Correlation	Process innovation	1.000	-.081	-.246	.154
	Size	-.081	1.000	.395	.014
	Certification	-.246	.395	1.000	-.069
	Customer focus	.154	.014	-.069	1.000
Sig. (1-tailed)	Product innovation	.	.232	.013	.082
	Size	.232	.	.000	.452
	Cert	.013	.000	.	.267
	Leadership	.082	.452	.267	.

A Pearson correlation of 0.154 (Table 4.46) was obtained for the relationship between leadership and process innovation and was found to be statistically significant at p value of $p < 0.1$ ($p = 0.082$). Similar to customer focus (hypothesis H_2), certification was found to be negatively correlated to process innovation with a correlation value of -0.246 and is statistically significant as the p value is less than 0.05 ($p = 0.013$). Firm size was found to have no influence. No evidence of multicollinearity was found and the histogram and P-P plot presented in Figure 4.9 below confirm reasonable normality of the data.

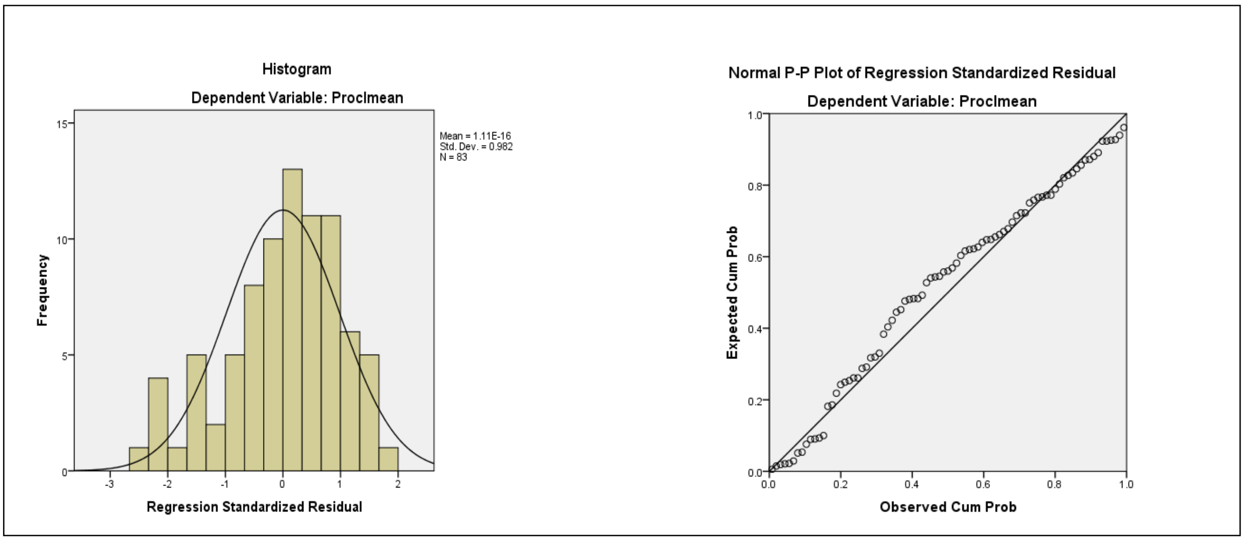

Figure 4:9: Histogram and P-P plots for data pertaining to hypothesis H4

Table 4.47: The Anova Results – hypothesis H4

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.492	2	3.746	2.582	.082[b]
	Residual	116.058	80	1.451		
	Total	123.550	82			
2	Regression	9.804	3	3.268	2.270	.087[c]
	Residual	113.745	79	1.440		
	Total	123.550	82			

As depicted in Table 4.47 above, both the first step and the second step in the hierarchal regression analysis run to investigate the relationship of leadership and process innovation were found to be statistically significant at p level of $p < 0.1$. Therefore, there was reasonable fit of the regression model and meaningful results were expected. The F statistic for the first step was $F = 2.582$ and $p = 0.082$, while for step two it was $F = 2.270$ and $p = 0.087$.

Table 4.48: Regression model summary for hypothesis H4

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.246[a]	.061	.037	1.20446	.061	2.582	2	80	.082
2	.282[b]	.079	.044	1.19992	.019	1.606	1	79	.209

a. Predictors: (Constant), firm size, certificati0on,

b. Predictors: (Constant), firm size, Certification, leadership

c. Dependent Variable: Process Innovation.

In Table 4.48, it can be seen that firm size and certification explained 6.41 % of variance in the process innovation data and was found to be statistically significant at p level of $p < 0.1$. The variable leadership only added 1.9 % in explaining the process innovation, but was found to be statistically not significant, and therefore hypothesis H_4 was rejected. This is because a p-value of 0.209 for 90 % confidence was obtained. The TQM dimension leadership was found to have no relationship with process innovation in the South African Foundry industry. However, certification was found to be negatively related to process innovation, as shown in Table 4.49 below.

Table 4.49: Coefficient of regression for leadership and process innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.491	.450		12.215	.000	4.596	6.386		
	Size	.030	.188	.019	.157	.875	-.345	.405	.844	1.185
	Certification	-.271	.126	-.253	-2.145	.035	-.523	-.020	.844	1.185
2	(Constant)	4.315	1.030		4.189	.000	2.265	6.366		
	Size	.019	.188	.012	.101	.920	-.355	.393	.842	1.187
	Certification	-.258	.126	-.241	-2.043	.044	-.510	-.007	.838	1.193
	Leadership	.203	.160	.137	1.267	.209	-.116	.522	.993	1.007

4.4.5 Testing for hypothesis H_5

Hypothesis H_5 was stated as:

H_5 (alternate): TQM dimension of people management has a positive relationship with product innovation.

Ho (null): There is no positive relationship between people management and product innovation.

Table 4.50: Pearson's correlations for hypothesis H5 variables

Correlations					
		Product innovation	Size	Certification	People management.
Pearson Correlation	Product innovation	1.000	.011	-.014	.262
	Size	.011	1.000	.395	-.075
	Certification	-.014	.395	1.000	-.064
	People management	.262	-.075	-.064	1.000
Sig. (1-tailed)	Product innovation	.	.462	.451	.008
	Size	.462	.	.000	.250
	Certification	.451	.000	.	.283
	People management	.008	.250	.283	.

According to Table 4.50 above, the Pearson's correlation between people management and product innovation was found to be 0.262, evidencing the relationship between people management and product innovation. This relationship was statistically significant at p value of $p < 0.05$. As explained earlier, firm size and certification were both found to be irrelevant as far as product innovation is concerned, as their relationships with it were not statistically significant. There is no correlation value that implied a problem of collinearity, as can be seen in Table 4.46. VIFs values and tolerance values support this conclusion. The data was also found to be close to normality, as depicted by the graphs in Figure 4.10 below.

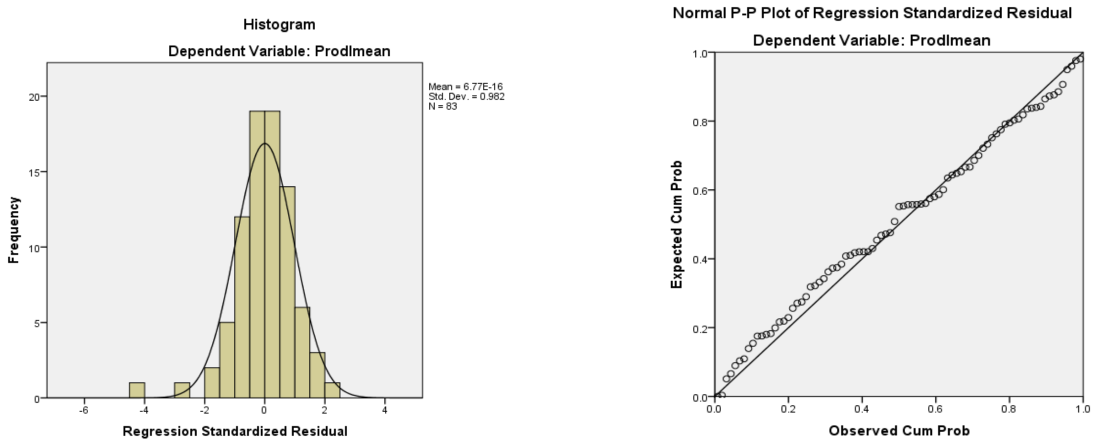

Figure 4:10: Histogram and P-P plots for data pertaining to hypothesis H5

Table 4.51: The Anova Results – hypothesis H5

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.040	2	.020	.020	.981[b]
	Residual	81.892	80	1.024		
	Total	81.932	82			
2	Regression	5.714	3	1.905	1.974	.125[c]
	Residual	76.218	79	.965		
	Total	81.932	82			

In Table 4.51 above, the analysis of variance for the regression analysis is presented and the results show that both the first step and the second step in the hierarchal regression were not statistically significant, suggesting a poor model fit.

On analysing the regression model summary presented in Table 4.52 below, it observed that people management accounted for 7.0 % of variance in the product innovation. This was statistically significant at p level of $p < 0.05$. The reason why the Anova table did not provide a statistically significant model was that all the three independent variables were included in the second model, and hence the impact of firm size and certification, which were known to have no relationship with product innovation, may have influenced the results.

Table 4.52: Regression model summary for hypothesis H5

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.022[a]	.000	-.024	1.01176	.000	.020	2	80	.981
2	.264[b]	.070	.034	.98224	.069	5.881	1	79	.018

a. Predictors: (Constant), firm size, certification,

b. Predictors: (Constant), firm size, Certification, People management

c. Dependent Variable: Product Innovation.

Table 4.53: Coefficient of regression for people management and product innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.054	.378		13.383	.000	4.302	5.805		
	Size	.025	.158	.019	.155	.877	-.290	.340	.844	1.185
	Certification	-.018	.106	-.021	-.174	.862	-.230	.193	.844	1.185
2	(Constant)	3.715	.663		5.604	.000	2.395	5.034		
	Size	.045	.154	.035	.292	.771	-.261	.351	.842	1.188
	Certification	-.009	.103	-.010	-.088	.930	-.214	.196	.843	1.186
	People management	.245	.101	.264	2.425	.018	.044	.447	.993	1.007

The coefficient of regression was found to be 0.245, and was significant at statistical value of $p < 0.05$, as shown in Table 4.53 above. Therefore, hypothesis H_5 was accepted and it can be stated that the TQM dimension of people management is positively related to product innovation.

4.4.6 Testing for hypothesis H_6

Hypothesis H6 was postulated as:

H_6 (alternate): TQM dimension of people management has a positive relationship with process innovation.

Ho (null): There is no positive relationship between people management and process innovation.

A positive Pearson's correlation was obtained between people management and process innovation, as depicted in Table 4.54 below. The correlation (r = 0.2880) was found to be statistically significant at $p < 0.05$. This gave initial support for hypothesis H_6. The correlation values between variables were well below the figures known to suggest the presence of collinearity, therefore valid regression analysis was deemed feasible. This assertion was supported by the tolerance and VIFs values which were within acceptable ranges.

Table 4.54: Pearson's correlations for hypothesis H5 variables

Correlations					
		Product innovation	Size	Certification	People management.
Pearson Correlation	Product innovation	1.000	-.081	-.246	.288
	Size	-.081	1.000	.395	-.075
	Certification	-.246	.395	1.000	-.064
	People management	.288	-.075	-.064	1.000
Sig. (1-tailed)	Product innovation	.	.232	.013	.004
	Size	.232	.	.000	.250
	Certification	.013	.000	.	.283
	People management	.004	.250	.283	.

The signs of normality in the data were found as depicted by Figure 4.11 below, so it was decided to proceed to conduct the regression analysis.

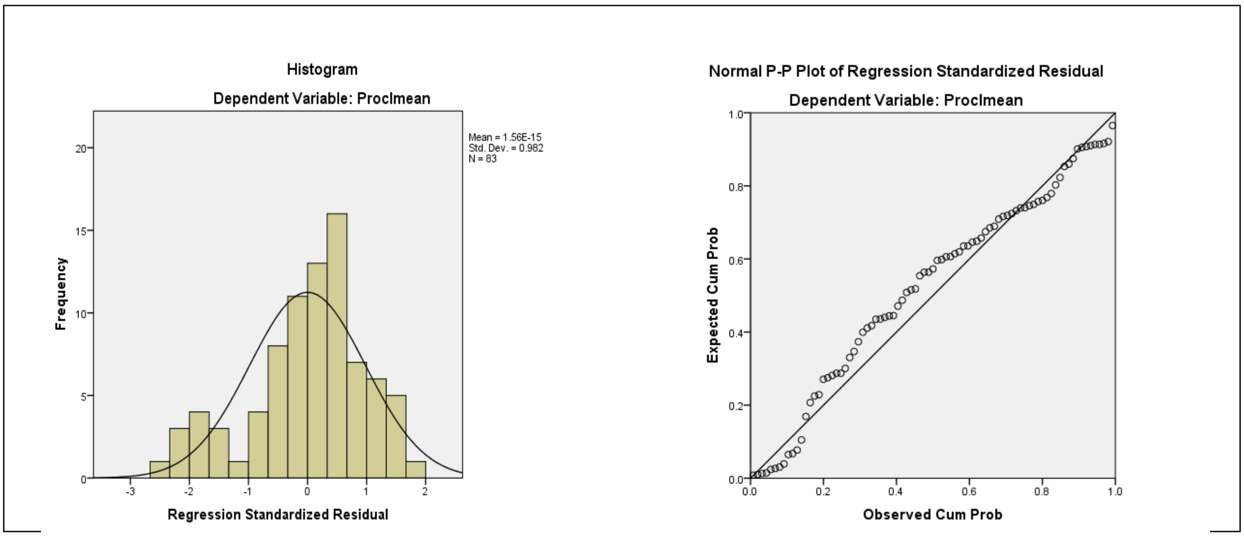

Figure 4:11: Histogram and P-P plots for data pertaining to hypothesis H5

Table 4.55: The Anova Results – hypothesis H6

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.492	2	3.746	2.582	.082[b]
	Residual	116.058	80	1.451		
	Total	123.550	82			
2	Regression	16.790	3	5.597	4.142	.009[c]
	Residual	106.759	79	1.351		
	Total	123.550	82			

The Anova results presented in Table 4.55 above show that the hierarchal regression analysis, both for the first step and the second step, is statistically significant and therefore the regression is a good fit for the data. Therefore, meaningful regression results would be possible.

According to Table 4.56 below, firm size and certification variables gave an R^2 of 0.061, suggesting that 6.1 % of variance in process innovation data is explained by firm size and time span of certification. The people management dimension accounted for a further 0.075 on R^2, suggesting that an additional 7.5 % of process innovation was explained by people management.

Table 4.56: Regression model summary for hypothesis H6

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.246[a]	.061	.037	1.20446	.061	2.582	2	80	.082
2	.369[b]	.136	.103	1.16249	.075	6.881	1	79	.010

a. Predictors: (Constant), firm size, certification,

b. Predictors: (Constant), firm size, Certification, People management

c. Dependent Variable: Process Innovation.

Table 4.57: Coefficient of regression for people management and process innovation

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.	95 % Confidence Interval for B		Collinearity Statistics	
		B	Std Error	Beta			Lower Limit	Upper Limit	Tolerance	VIF
1	(Constant)	5.491	.450		12.215	.000	4.596	6.386		
	Size	.030	.188	.019	.157	.875	-.345	.405	.844	1.185
	Certification	-.271	.126	-.253	-2.145	.035	-.523	-.020	.844	1.185
2	(Constant)	3.777	.784		4.814	.000	2.215	5.338		
	Size	.056	.182	.035	.306	.761	-.307	.418	.842	1.188
	Certification	-.259	.122	-.242	-2.122	.037	-.502	-.016	.843	1.186
	People management	.314	.120	.275	2.623	.010	.076	.552	.993	1.007

The coefficient of regression parameter beta for people management was found to be 0.314 and statistically significant at $p < 0.01$, while that for certification was -0.259 at $p < 0.05$ (see Table 4.57 above). The results presented show that people management is positively related to process innovation and therefore hypothesis H_6 is supported.

Tables 4.58 and 4.59 overleaf presents the summary of regression results for the TQM dimensions on product innovation and process innovation respectively.

Table 4.58: Summary regression analysis of TQM dimensions on product innovation

Construct	B	SE	β	R^2	p	Verdict
Customer focus	0.327	0.163	0.220	0.049	0.049	accepted
Leadership	0.349	0.130	0.290	0.084	0.09	accepted
People management	0.245	0.101	0.264	0.070	0.018	accepted

Table 4.59: Summary regression analysis of TQM dimensions on process innovation

Construct	B	SE	β	R^2	p	Verdict
Customer focus	0.248	0.197	0.136	0.018	0.213	rejected
Leadership	0.203	0.160	0.137	0.019	0.209	rejected
People management	0.314	0.120	0.275	0.075	0.010	accepted

4.5 Conclusion

In this chapter, all the results of the research work were presented. The profiles of the respondents were presented and their responses were first analysed using descriptive statistics. The scales used in this research were then checked and were found to be reliable, and validity was good, so as to give credible results. The response results were then used to test the hypotheses put forward using a multiple regression technique. It was found the customer focus and leadership dimensions of TQM were positively related to product innovation, while no relation was found with process innovation. However, people management was found to be positively related to both product and process innovations.

CHAPTER FIVE: DISCUSSION OF RESULTS

5.1 Introduction

This section describes the results obtained from this study and relates them to extant literature to fill the gaps that have been identified. The first section briefly recaps on the rationale of the study, followed by a synopsis of the literature, and then a profiling of respondents. The analysis of the reliability and validity of the scale used is discussed, and the results obtained from the testing of the different hypotheses proposed are finally discussed in relation to the existing literature.

4.2 Rationale of the study

This study sought to investigate the role of TQM dimensions of customer focus, leadership and people management in influencing product and/or process innovations in the South African steel industry. The industry is saddled with depressed steel demands and overcapacity in facilities for steel production, which has seen prices falling due to increased competition. It is therefore imperative that firms become innovative in order to survive.

With most organisations employing one or other form of total quality management, and some being certified under systems such as the ISO 9000 quality management system, the study sought to establish whether any relationship exists between TQM dimensions and either product or process innovation. Postulating a positive relationship, firms would leverage on the practices enforced by TQM to enhance their innovative capabilities. While the relationship between TQM and innovation has been studied and contradictory views obtained, most of the studies tended to aggregate firms that belonged to different industries. As challenges and opportunities differ from industry to industry and from time to time, this study focused on a single industry facing a similar environment. In addition, most studies did not clearly delineate the TQM dimensions and types of innovation in their studies (Abrunhosa & Sa, 2007), and therefore did not capture clearly the different impacts which the dimensions have on the individual types of innovation.

4.3 Profile of the respondents

Despite targeting a broader spectrum of foundry personnel as respondents, this study showed that about 44 % were in management positions. The motive for including broader classes of employees was due to the realisation that TQM is a comprehensive philosophy that involves the entire workforce and embraces all aspects of the organisation. Accordingly, a more accurate perceptual judgement of the level of TQM implementation would be obtained from a broader purview of respondents. Similarly, at all levels in an organisation, all employees are encouraged to be involved in innovation processes. In some firms, the gatekeepers (management) did not tolerate the involvement of lower levels of employees in giving information pertaining to their company to outsiders. The results show that most of respondents were from organisations that had attained certification more than 10 years prior to this survey.

4.4 Influence of firm size and certification of a quality management system on innovation performance

The firm size and the period since the organisation had attained certification of the quality management system were used as the control variables in this study. Firm size (B=0.038, p=0.810) did not contribute significantly in explaining product or process innovation. However, certification was found to have no significant effect on product innovation (B = -0.012, p = 0.909), but was negatively related to process innovation, with a coefficient of regression of -0.266 and p=0.038. The negative impact of certification can be attributed to the procedures that trap employees to work in a routine way and hence kill their creativity.

The findings of this work contradict those of Pekovic and Galia (2009) who found a positive and significant correlations between ISO certification and innovation performance, characterised by products and processes, and innovation activities, such as expenditure and number of innovation projects that an organisation pursues.

Despite the negative effect that certification seems to have on both product and process innovation, this does not undermine the importance of certification in today’s business environment. López-Mielgo, Montes-Peón and Vázquez-Ordás (2009) argued that certification gives customers the confidence that the firm’s production processes are controlled to satisfy quality specifications. As Terlaak and King (2006) have reported, the importance of certification was summed up by one manager who remarked, “it is similar to having a college diploma” (p.4). This implied that, as college diplomas help in differentiating high productivity job applicants from low productivity ones, so does certification help to signal a firm’s quality credentials to old and new customers. It gives assurance to customers that products produced by the firm are of high quality.

Certification demands documentation of the procedures of every process done in order to ensure control over the process by doing the set activities in the same way, over and over again. Such procedures demand control and variance reduction, which contradicts the change that is crucial for innovation to take place or succeed. Set procedures limit experimentation, and thus stifle creativity. Procedures foster a culture of variation reduction, which does not mesh well with the more free-thinking and risk-taking culture required for fostering new ideas.

These results concurred with the empirical studies reported by Cole and Matsumiya (2007) who cited the work by Banner and Tushman who found that the greater the numbers of ISO certifications there were, the fewer the numbers of original patents there were in the paint and photography industries. This implied that ISO certification stifled innovation, resulting in fewer patents being obtained. Exploratory innovations that might lead to more patents are often crowded out by a focus on variance reduction.

Procedures set out activities that are sufficiently routine to be well understood, hence they produce consistency in product quality. They trap people into staying with what is workable, as they believe it is the “best solution”. This leaves organisations stuck in repeated way of doing things, without any room to explore new ones. Standardisation reduces the variability in any task which is necessary to foster innovation. Innovation is more experimental, favoured by a trial and error approach, owing to uncertainty of the end result.

4.5 The role of customer focus on product and process innovation

Seven scale items were initially used to capture data for customer focus, but these were reduced to five to improve scale reliability from 0.724 to 0.782. On conducting the factor analysis, these items extracted only one factor with an eigenvalue greater than one, suggesting the uni-dimensionality of the scales. The regression analysis revealed that customer focus explained a statistical significance of about 4.9 % of variance in product innovation, with a regression coefficient of 0.37 at $p < 0.05$ or better. Therefore, customer focus was found to be positively related to product innovation. Hypothesis H_1 was accepted.

However, the regression analysis investigating the relationship with process innovation was not statistically significant and therefore hypothesis H_2 was rejected, i.e. no relationship was found between customer focus and process innovation.

The low explanatory power of customer focus on product innovation should not be viewed in an adverse manner. It should be noted that the primary purpose of TQM is to achieve higher quality performance, rather than innovation performance, and therefore the low explanatory values should not be used a basis to discount the importance of TQM in organisations.

The finding that customer focus is positively associated with product innovation is supported by some researchers in extant literature who have argued that this dimension stimulates organisations to search for new customer needs and expectations, and to develop and introduce new products in the endeavour to always create value for their customers. Lee et al. (2010), in their research in the Malaysian industry, found that customer focus positively promotes product innovation performance.

The attainment of higher quality under the auspices of TQM demands the use of standards and a reduction in variation, which are elements that are not conducive for, or do not promote, innovation because they exclude experimentation and change. Prajogo and Sohal (2001) argued that through customer focus, firms produce products to specifications in order to meet customer's requirements, and therefore fail to search for customers' latent needs. By doing so, they fail to drive generative learning, which is nurtured by searching for the unserved, untapped potential markets. They argued that managers see the world only through their current customers' eyes. Therefore, the results of this study contradicts the argument put forward by these authors.

4.6 The role of leadership in product and process innovation

Judging by the reluctance of management to allow the participation of lower levels of employees in this research study, it can be inferred that the predominant style of leadership in most of the foundries is more of transactional leadership, rather than of transformational leadership. It shows that employees are not empowered.

The six scale items pertaining to the leadership dimension gave a Cronbach's alpha of 0.863, confirming the reliability of the scale, and all items were relevant and were retained. Factor analysis extracted only one factor with eigenvalue greater than one, implying that all the items used belonged to a common theme of leadership. The regression analysis results revealed that the leadership dimension explained 8.4 % of product innovation variance, thus implying that leadership is positively associated with product innovation. Hypothesis H_3 was accordingly accepted. However, no relationship was found between leadership and process innovation, as the results were not statistically significant. Hypothesis H_4 was therefore rejected.

De Jong and Den Hartog (2007) argued that leaders who create a positive and safe environment, where openness and risk-taking are encouraged, tend to promote creativity and innovation. The results of this study are in support of the work by Lee et al. (2010) who concluded that TQM dimensions are positively associated with the level of product innovations. More precisely, they found that leadership and customer focus were positively related to product innovation. Their findings concurred with those of Hoang et al. (2006) who, while working with Vietnamese firms, found that leadership has a positive influence on product innovation. Therefore, the findings of this study are supported by findings of other researchers on product innovation.

In this research work, no significant association was found between leadership and process innovation. This lack of association may be attributed to the need to adhere to set procedures for all production processes, as imposed by certification. This means that processes have to be followed as described by the set procedures, and this constrains the workers from experimenting and therefore discovering new methods of doing the work. Procedures will only be reviewed where problems are encountered in terms of the quality of products, otherwise they would not be changed, and therefore the opportunity to experiment and improve on them is lost. Al-Husseini, Elbeltagi, and Dosa (2013) reported that transformational leadership style has a positive impact on both product and process innovation. However, in this study, no attempt was made to measure the characteristics of leaders to establish their leadership styles.

4.7 The role of people management on product and process innovation

The reliability of scale items pertaining to people management had a Cronbach's alpha of 0.883, and factor analysis yielded only one factor, confirming that all the seven items used measured a common theme of people management. The regression analysis results revealed that people management explained 7 % of product innovation data, at statistical significance of 0.05 or better. The coefficient of regression was found to be 0.245 and was statistically significant, hence it was concluded that people management is positively related to product innovation. Similarly, people management explained 7.5 % of process innovation, with a statistically significant regression coefficient of 0.314 at $p < 0.01$. Therefore, people management was found to be positively related to process management. Hypotheses H_5 and H_6 were therefore supported, meaning that people management is positively associated with both product and process innovation.

Abrunhosa and Sa (2008) argued that the implementation of people management practices, such as continuous education and training and the use of appropriate appraisal systems, is significantly associated with the adoption of innovation. This is because a qualified workforce is a strong driver for innovation. People management gives employees space and responsibility to make decisions, and flexibility in performing their daily activities. Therefore, the findings of this study concurred with the conclusion of Abrunhosa and Sa (2008), as people management was found to be positively related to both product and process innovation.

Santos-Vijande and Alvarez-Gonzalez (2007) pointed out that the two key variables for the development of an innovative culture are participatory decision-making and the learning and professional development of employees. The latter variable was measured in this study by item PM7 (We have an organisation-wide training and development process, including career path planning, for all our employees) and was scored favourably high.

Lorente et al. (1999) proposed that training elevates the morale and confidence of employees, creating a work environment that is conducive to work in, and hence innovation processes can be achieved much better.

Prajogo and Sohal (2003) found that there is a strong association between product quality and process innovation, and they concluded that as firms push for increased product quality, they adopt and implement rigorous process innovations to achieve that, for example new technology in order to enhance process capability. They also asserted that TQM has a greater association with product quality, followed by process innovation, and then product innovation.

4.8 Conclusion

The results of this study show that product innovation is supported by all the three dimensions of TQM, namely customer focus, leadership and people management, which were investigated in this research work. However, only people management is positively related to process innovation. These findings collude with the findings of some researchers while it contradicts the findings of others.

CHAPTER SIX: CONCLUSION

6.1 Introduction

In this chapter, all the findings of this study are summarised, and the conclusions that were drawn, and how they relate to the extant literature, are described. Furthermore, the implications of the findings are presented, together with recommendations for future work and practical solutions for industrialists to implement in order to gain benefits for their organisations, where possible. The limitations faced in conducting the study are also presented.

5.2 Findings and Conclusions of the study

The research question in this study sought to establish whether TQM dimensions provide a conducive environment for product and process innovation to flourish. The study was motivated by the need to seek strategies that can help the struggling steel industry in South Africa. The industry is currently affected by viability challenges caused by the overcapacity in steel production in the world and falling demand for the commodity, caused by the slowing down of the global economy. Due to their economies of scale, international producers are flooding the local market with cheap steel products, and strategies to deal with the cheap steel products, mainly from China, are being sought.

Innovation has recently been seen as a leading competitive advantage strategy, taking over from total quality management, as it enables firms to introduce new products and new processes that the competition cannot easily match and therefore provides a competitive edge. Moreover, for the foundry industry in South Africa, innovating is no longer a choice but a necessity. Total quality management, which has been adopted by many organisations in order to promote the quality their products over competition, has been considered a viable tool for catapulting the innovation programmes in organisations. Accordingly, the identification of the relationship between total quality management and innovation is of paramount importance.

The extent of the implementation of TQM in the organisations that participated in this study was found to be very high, with the mean scores ranging from 5.17 to 6.01 on a seven-point Likert scale for the dimensions of customer focus, leadership, and people management. This showed that the participants responded positively to the statements measuring these dimensions. Therefore, it was concluded that the TQM dimensions are well ingrained into the culture of the organisations and that the employees were acquainted with them. In addition, most organisations have held certification of their quality management systems for more than ten years. Another important finding is the high correlation values obtained among the TQM variables, which reflect the holistic nature of TQM and imply that its dimensions reinforce one another.

In terms of the research methodology, the measuring instrument was found to be valid and reliable for use in the South African context for measuring both the TQM and innovation constructs. This is very important as the measuring instrument used was adopted from other continents with different cultures. The psychometric measurement instruments were reported to be sensitive to different cultures (Adonisi, 2003). Therefore, these instruments can be used for future research work.

The control variables used in the study of firm size and period of certification were found not to have any impact on product innovation, while certification was surprisingly found to be negatively associated with process innovation. This negative impact was attributed to the demand imposed by certification requirements to have all processes/activities documented in set procedures that are strictly followed whenever the process or activity is performed. This is meant to reduce variation and exert strong control over the process, and thus ensure consistency in the quality of the product produced. In this regard, set procedures restrain the freedom to experiment, which is necessary for the innovation process.

Customer focus was found to be positively associated with product innovation, with an R^2 of 0.049, at p level of $p<0.05$, while no statistically significant relationship was established with process innovation. Although customer focus only explains 4.9 % of variance in product innovation, this is important when it is considered that the primary purpose of this TQM dimension is to align organisation products with customer needs through ascertaining those needs prior to making the products. Although the relationship between customer focus and process innovation was positive, it cannot be claimed that this dimension supports process innovation, as the results were not statistically significant, which led to the rejection of hypothesis H_2.

In the context of TQM, the leadership role is to create and communicate a clear vision regarding quality, to provide resources needed, and to encourage a culture of continual improvement and change. Leaders should also participate in quality meetings and learn quality-related skills. In this study, leadership was found to be positively related to product innovation, with R^2 of 0.083, while no statistically significant relationship was established with process innovation. Therefore, it can be concluded that leadership helps in providing a conducive environment for product innovation to prosper.

People management in the TQM context pertains to how the employees are managed to enable them to use their full potential for the benefit of the organisation. They need to be empowered and involved, and regularly trained so as to develop the technical and behavioural skills necessary for them to perform their duties well. Reward and recognition motivate them to deliver, and participation in a cross-functional team is key for them to develop and learn. The people management concept of TQM was found to be positively associated with product innovation, with R^2 of 0.07, implying that people management accounts for 7 % of product innovation. In addition, people management was found to be positively related to process management, with R^2 of 0.075. This means that people management explains 7.5 % of process management.

Martinez-Costa and Martinez-Lorente (2008) argued that people management promotes empowerment, which is known to play a major role in fostering creativity in an organisation. Prajogo and Sohal (2001) also argued that cross-functional communication is promoted in a TQM environment and this is crucial in fostering organisational innovation. These arguments support a positive relationship between people management and process and product innovation.

Manders et al. (2016) argued that by empowering employees, it gives them greater autonomy and responsibility, which are essential for them to be innovative. People will generate more ideas if they know that they are valued by management (Santos-Vijande & Álvarez-González, 2007).

TQM alone is not a sufficient driver for process and product innovation, as judged by the low R^2 values, and it must be complemented by other measures if innovation is to be achieved at higher figures.

This study has contributed to the literature development of the subject by providing an understanding of the relationship between TQM and innovation in the South African context. It is also important to mention that most studies in extant literature have not clearly delineated the TQM or forms of innovation in their study, which has made comparison of results difficult.

5.3 Limitations of the study

The major limitation of this study is that not all dimensions of TQM and innovation were studied, owing to the time constraints within which to complete this study. Although the study focused on understanding the effects of individual TQM dimensions on the forms of innovation, it is important to expand the TQM dimensions, as they are always implemented as a composite and are often complementary and reinforcing of one another.

This study used the convenience sampling technique to choose the participants for the study. This was facilitated by the link this researcher has with the mother body for the foundry industry in South Africa, and this was crucial for obtaining sufficient responses for the study. Therefore, the conclusions of this study cannot be generalised for other industries in South Africa. In addition, the cross-sectional methodology was used, with data being collected at one point in time. The limitation of this design is that causal inferences cannot be made, as it represents a snapshot in time and if another timeframe had been chosen, different results might have been obtained. The other drawback is that it uses predetermined questions which may fail to completely comprehend the respondents' perceptions. Ideally, longitudinal sampling would have been best as it eliminates the effects of the current challenges facing the industry and therefore would lead to a better understanding of the relationship between TQM and innovation in the foundry industry.

5.4 Recommendations

From a practical viewpoint, it is recommended that the firms that desire to improve their innovation performance as a means of enhancing their competitiveness should embrace TQM, as it has been found that it contributes positively to product innovation and does not hinder process innovation. However, the effect of the full complement of TQM dimensions should be studied to establish their relationships with the forms of innovation. This will provide a holistic understanding of the relationship between TQM and innovation.

The primary reason for the deployment of TQM is to enhance the quality of products so that they can meet the needs and expectations of the customers. It is, therefore, important to establish the link between quality performance and both product and process innovations. This is crucial because these parameters are both important for an organisation.

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APPENDIX 1

Cover letter and Research Instrument

Re: Request for your participation on TQM/ innovation research in the South African Foundry Industry.

Dear Valued Respondent.

I hereby request for your participation in the research that I am conducting on the relationship of Total Quality Management (i.e. ISO 9001 Quality Management System adoption) and innovation in the South African Foundry industry. Innovation is the mechanism by which organizations produce new products, introduce new processes and systems required for adapting to changing markets, technologies and global competition. While the TQM adoption is crucial for an organization to meet its quality objectives, research has shown that innovation is now the main source of competitive advantage that organizations can use to stay ahead of competition.

This research is part of my studies for a Master of Entrepreneurship and New Venture Creation degree at Wits Business School. I would be grateful if a few individuals in your organization participate by completing the attached questionnaire (CLICK ON THE LINK IN THIS EMAIL OR COPY AND PASTE IT INTO YOUR INTERNET BROWSER**)**. The respondents may fall into any of the following categories where possible; management, supervisor (middle management), quality department personnel, shop-floor employees (artisans, etc). The reason for this is that TQM is a company-wide initiative and perceptions of a broader spectrum of members of the organization is important.

The participation of your organization and team members will be treated in highest confidence of confidentiality. No names or any form of identification of participants are needed.

Completing the attached questionnaire will only take less than 10 minutes of your valuable time. Your participation is voluntary but is greatly appreciated and means a lot for my studies.

Thank you in advance for your participation in the research work.

Please forward the email to other members of your organization whom you feel can provide valuable feedback.

Yours Sincerely

Mainford Toga.

Research Instrument - Questinnaire

The relationship between Total Quality Management and Innovation in the Southern African Steel Industry

(This instrument was adapted from the works of Kim, Kumar & Kumar (2012), Ooi, Lin, Teh & Chong (2012) and Prajogo and Sohal, 2006).

This survey consists of only 32 questions that will take between 5 to 8 minutes of your time. The survey is anonymous and there is no way to link it back to you or your organization. Please answer all questions by marking on answer of your choice,

Q1 Please indicate your occupation level in your organization.

☐ Management ☐ Quality Assurance / Quality Control Department ☐ Supervisory
☐ Shop floor ☐ Other / Specify ____________________

Q2 Please indicate your gender

☐ Male ☐ Female

Q3 How many years does your company have since attaining ISO 9000 quality system certification.

☐ less than one year ☐ 2 to 5 years ☐ 6 to 10 years ☐ Over 10 years

Q4 How many employees does your firm have?

☐ less than 50 employees ☐ 50 to 200 employees ☐ 201 to 500 employees ☐ Over 500

For each of the following statements, please select one of the given options that closely reflects your assessment of the effectiveness of the quality system in your organization.

Q5 (CF1): The needs and expectations of our customers are regularly sought.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q6 (CF2): Customer needs and expectations are effectively communicated and understood by all employees.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q7 (CF3): Customer complaints that are quality related are treated with top priority in our company.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q8 (CF4): Our customers freely communicate with us and we maintain a close relationship with them.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q9 (CF5): Customer complaints are actively resolved in our company.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q10 (CF6): We systematically and regularly measure customer satisfaction.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q11 CF7): We always do market research in order to collect ideas or suggestions for improving our products or services.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q12 (LD1): Our management actively encourages a culture of learning, improvement, innovation and change towards excellence.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q13 (LD2): Our leadership provides adequate resources for improvement of the quality of our products and services.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q14 (LD3): In our company, individuals and/or departments are united by common purpose and no barriers exist between them.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q15 (LD4): Our Leadership actively participates in quality management meetings and contribute with improvement ideas.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q16 (LD5): Our leadership encourage all employees to participate on quality involvement initiatives and programmes.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q17 (LD6): Our leadership learn quality related skills and issues.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q18 (PM1): Employees communicate their ideas freely to management and vice-versa.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q19 (PM2): Feedback on employee satisfaction is formally and regularly sought.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q20 (PM3): We always maintain a work environment that contributes to the health, safety, and well-being of all employees.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q21 (PM4): In our company, quality is every employees' responsibility.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q22 (PM5): Reward and recognition system within the company is based on the accomplishment of quality work among other factors.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q23 (PM6): Our organization, both individual and teamwork contributions are rewarded accordingly.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q24 (PM7): In our firm training, learning programmes and career path development are available for all our employees.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

For the following statements, select the best possible answer that reflects the aspects related to product and process innovation in your organization in relation to your industry's norm.

Q25 (Prod1): Our company is always ahead of competitors in producing new products (new product introduction in the market).

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q26 (Prod2): The new products produced by our firm significantly differ from our existing products. The level of newness is high.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q27 (Prod3): Our firm has introduced a number of new products to the market in the last 3 years.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q28 (Prod4): When introducing new products, our firm does so in the shortest possible time compared to others in the industry.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q29 (Proc1): Our firm has introduced new or significantly improved machinery and/or equipment for producing products.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q30 (Proc2): Our firm has introduced new or significantly modified productive processes for producing products.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q31 (Proc3): Our processes are the most up-to-date and novel in our industry

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Q32 (Proc4): Our firm quickly change its processes, techniques and technology faster than competition when required.

Strongly agree	Agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Disagree	Strongly disagree

Thank you for taking part in this survey. Your response is anonymous and confidential.

APPENDIX 2

Consent to take part in the survey

The Graduate School of Business Administration

2 St David's Place, Parktown,

Johannesburg, 2193,

South Africa

PO Box 98, WITS, 2050

Website: www.wbs.ac.za

MM RESEARCH CONSENT FORM

The relationship between Total Quality Management (TQM) and Innovation study

INFORMATION SHEET AND CONSENT FORM

Who I am

Hello, I am **Mainford Toga** (student number 1549112). I am conducting research for the purpose of completing my MM at Wits Business School

What I am doing

I am conducting research on evaluating the relationship between TQM and innovation. I am conducting a quantitative study with at least 100 ISO 9001 certified organizations in the steel industry to establish the relationship between TQM and innovation.

Confidentiality

Your responses will be treated with strictest confidentiality. All respondents are anonymous.

The study records will be destroyed after the completion and marking of my thesis. I will refer to you by a code number or pseudonym in the thesis and any further publication.

Benefits

There are no immediate benefits to you from participating in this study. However, this study will be extremely helpful to us in understanding correlation between TQM and innovation.

If you would like to received feedback on the study, I can send you the results of the study when it is completed sometime after 28 February 2017.

Who to contact if you have been harmed or have any concerns

This research has been approved by the Wits Business School. If you have any complaints about ethical aspects of the research or feel that you have been harmed in any way by participating in this study, please contact the Research Office Manager at the Wits Business

School, Mmabatho Leeuw. Mmabatho.leeuw@wits.ac.za

If you have concerns or questions about the research you may call my academic research supervisor Professor Boris Urban on 011 717 3629.

CONSENT

I hereby agree to participate in research the relationship between TQM and innovation. I understand that my organization is participating freely and without being forced in any way to do so.

I understand that this is a research project whose purpose is not necessarily to benefit me personally in the immediate or short term.

I understand that my participation will remain confidential.

Name /Signature of participant or Gate Keeper --

Date………………………………………